# ECONOMIC GEOGRAPHY


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# ACKNOWLEDGMENTS

To a host of students, authors, and friends I am greatly indebted in one wa or another Often in my classes a bright student has evoked a question or a idea that has become part of this volume, and I regret that I cannot make spe cific personal acknowledgment to each of these. Several young geographer through their field work provided detailed maps and descriptive materials tha have served as the bases for the concrete examples of activities in many regions credit is accorded to many of these under the maps I owe much to authors fo considerable new literature in *Economic Geography*, the *Journal of Geograph* the *Geographical Review*, the *Bulletin of the Geographical Society of Phila delphia*, the *National Geographic Magazine*, and foreign geographical journal For material on selected industries and areas I thank many business corporation and governmental organizations I am especially indebted to President Wallac W Atwood for making research and writing possible, and for the constan stimulation that comes from association with an active, successful author. Fo constructive criticisms and valuable comments I acknowledge a debt of gratitud to several who carefully read and tested portions of the manuscript in high school classes. Among these are George S Corfield, Duluth, Minn., Gordon C Darkenwald, Wimbledon, N D , Charles Gooze, Washington, D. C., Thomas F Hunt, Bellingham, Wash , L Dudley Stamp, London, England , Kaoru Tanak Kobe, Japan , James A Minogue, Duluth, Minn , Clarence D Rotruck, Ander son, Ind., Viola Grove, Poughkeepsie, N Y , Margaret Means, Bloomingto Ill., Harry K. Hutter, Aberdeen, S D., Ann Scharf, Long Beach, Calif , Theres McQueeny, Worcester, Mass , Adelbert K Botts, Courtland, N Y , Nell I Melton, Atlanta, Ga.; Minnie M. Hatten, Galesburg, Ill ; and Flora M Stapl Duluth, Minn. I thank Adelbert K Botts and George Etzel Pearcy for pain taking and excellent cartographic work, and Clarence Volk Jones for serving a a willing subject on whom the materials have been tested, Misses Helen Elli and Edith Baker, librarians, for securing materials difficult to obtain, and Mr Clarence F. Jones and Gertrude Gundersen for typing, proof reading, checkin materials, and indexing.

Clarence Fielden Jones.

# PREFACE

The general plan of organization of *Economic Geography* is by types of in dustries or occupations hunting and fishing, grazing, farming, lumbering anc gathering of forest products, mining, manufacturing, and trade The details o organization and presentation of materials within this general scheme have bee developing with each repetition of the course in economic geography as I hav taught it for more than a decade The plan of presentation of the materials i new and stimulating it replaces the old cyclopaedic enumeration of facts Em phasis is placed on the relation of physical and economic conditions to the pro duction of and trade in commodities

A varied approach to the different units commands the pupil's interest Man units are introduced by concrete examples rather than by statements of genera principles For example, a sugar plantation in Cuba introduces the section o sugar, the Darkenwald wheat farm introduces the unit on cereal farming i semiarid plains, the copper camp at Bingham, Utah opens the unit on coppe and tin, and the Birmingham region opens the unit on the manufacturing c iron and steel From detailed examples, the presentation leads naturally to th relations of sugar culture in Cuba and other regions in the world, wheat in th semiarid plains of the continents, copper mining in the United States and els where, and the manufacture of iron and steel in other sections of the Unite States and the world To avoid undue repetition and to simplify the treatmen the production of these commodities in other regions is viewed in comparison ar contrast with the type region

As the manuscript advanced from the first copy to final form, the subject ma ter and method of treatment have been tested in high-school classes in differe parts of the country and modified according to the many suggestions of teache and pupils The subject matter is divided into convenient units to facilita daily assignments and to serve in a program of directed study Numerous ex cises and questions have been embedded in the body of the text, in the legends the illustrations, and at the end of the units to encourage a careful study of t illustrations and text, to emphasize the significant aspects of the units, to tra the student in methods of study, and to test the student's knowledge of t subject.

The book is designed to serve for either a half- or a full-year course The su ject matter and many of the exercises are planned for a half-year course But the end of the units appear suggestions for extra lessons, readings, and topics investigation and report, and a wise use of these supplementary materials v expand the course to serve as a whole year's work in economic geography If book is used as a text for a half-year's course, some of the readings and top may be assigned for extra credit work by honor students Care has been ta

to select references that contain material bearing directly on the units of study

The large number of pictures, maps, and charts were secured or prepared by the author and his cartographers especially to illustrate and supplement the textual material Additional exercises may be based on the maps, graphs, and climatic charts, according to the interests of teachers and pupils

C F J

CLARK UNIVERSITY,
March, 1935

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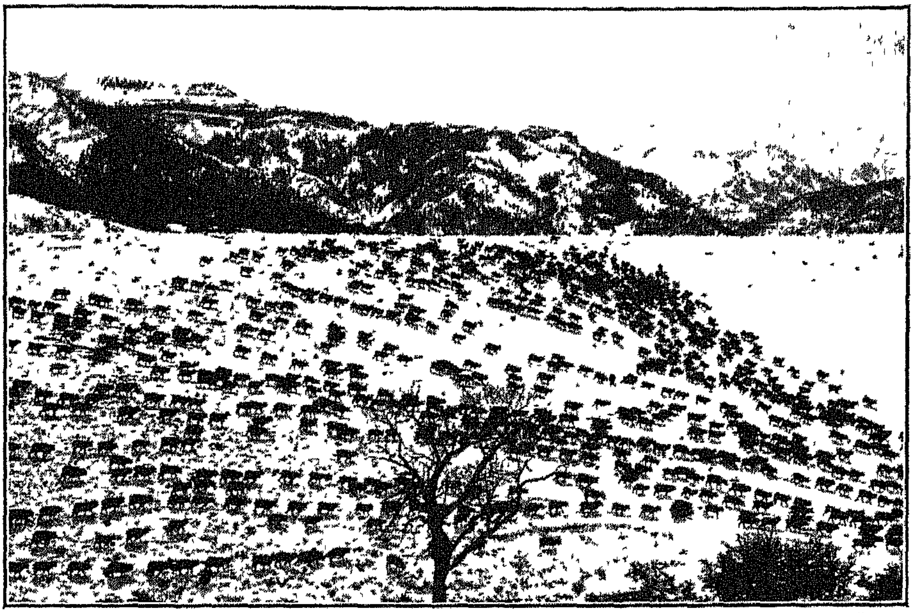
# PART I

# THE MEANING OF ECONOMIC GEOGRAPHY



*Courtesy of Charles J Belden*

SHEEP LEAVING SUMMER PASTURES IN THE ROCKY MOUNTAINS

FIG 1. When heavy snows come, mountains are beautiful places for winter sports, but sheep leave the high summer pastures for warmer areas with more feed People living here have a choice of what occupations? How many people per square mile live in this region?

CHAPTER I

# THE DISTRIBUTION OF PEOPLE

Everyone likes to travel. Most of us wish to visit distant lands. Some want to be explorers and learn the ways of the Eskimo or the forest Indians who gather Brazil nuts on the Amazon. Many wish to hunt lions and tigers in the forests and savannas of Africa Others desire to fly as mail pilots to distant lands and peoples Some plan, as engineers, to build great bridges, skyscrapers, or tunnels Some, as bankers, hope to direct the finances of great industries, cities, and even countries

**The Work of Different Regions.** Whether young men and women do the things they would like to do when they grow up depends on many things, but especially on the kind of country they live in and the number of neighbors nearby (Fig. 1) Eskimos spend much of their time hunting and fishing to obtain food and clothing. Indians on the Amazon gather food from forest and streams; they don't have to work as hard as the Eskimos. Not many people live in Eskimo land or in the Amazon forest, but their youths have to learn to do the things their parents did. Their education in the school of experience enables them to live by obtaining food, shelter, and clothing The Kirghiz nomads of Asia spend most of their time wandering

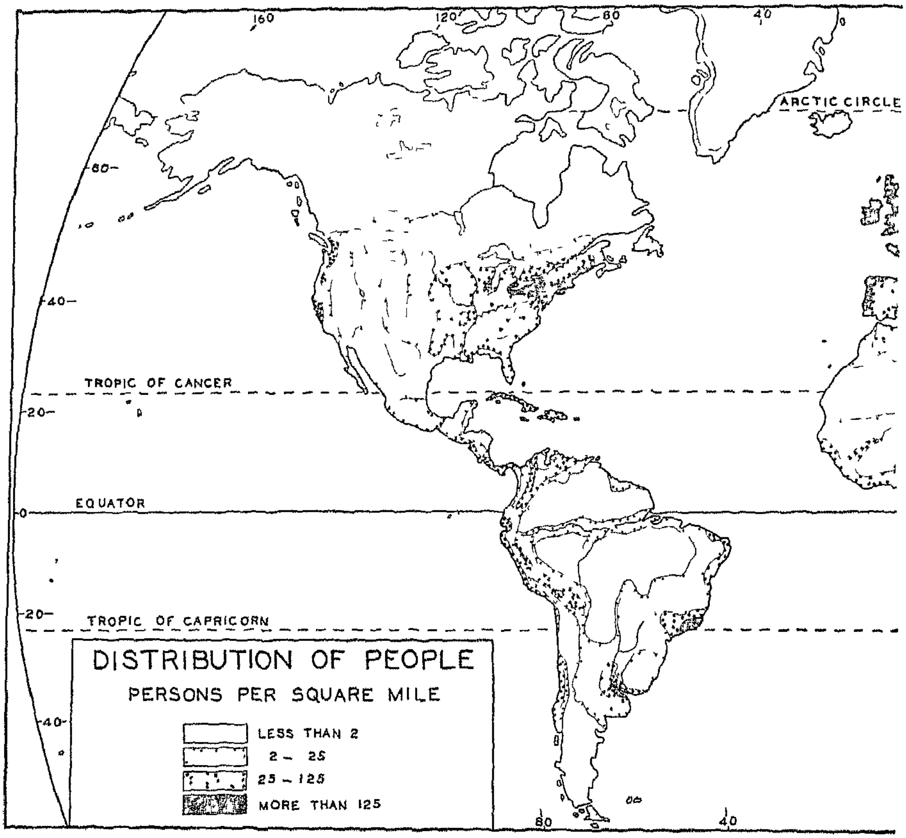
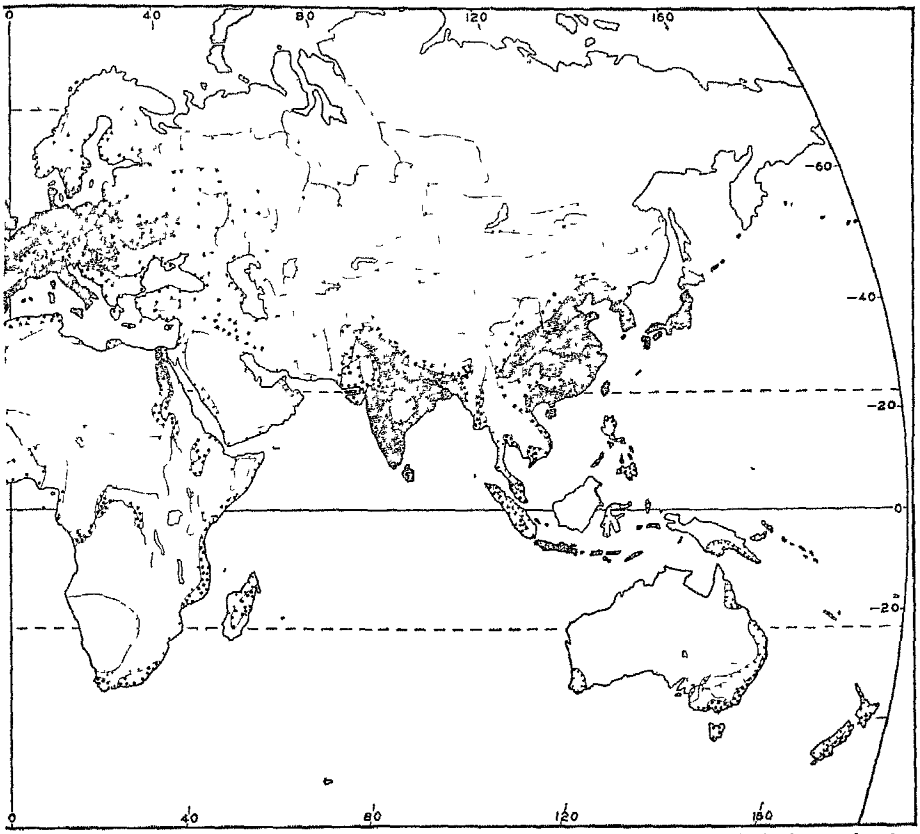



FIG 2 In a study of economic geography the map of the distribution of people arid wheat farming areas it is sparse, but in rice farming and manufacturing regions there places and more than one thousand per square mile in many districts

with flocks and herds in search of food and water If the nomads have too many cattle, some die when grass or water gives out. Not many people live in lands of nomadism. The farmers of China, India, and Japan, in regions with many people, make small farms of a few acres produce most of their food. In big cities the business man, engineer, and others give little time directly to getting food. In the United States about one-fifth of our workers farm or tend animals. Thus we see that some lands make possible only a few simple occupations, while others present many opportunities for young people Some lands present almost no chance for people to make a living

**Questions to Think About.** Why do you suppose the Indians of central North America gave the name Eskimos, which means "eaters of raw flesh," to the more northern tribes? Why are the Eskimos "eaters of raw flesh"? What opportunities does Eskimo land present for occupations other than hunting or fishing? Why are the Indians of the Amazon hunters, fishermen, and gatherers of forest products? Why do the Kirghiz tribes follow nomadism? Why can't they

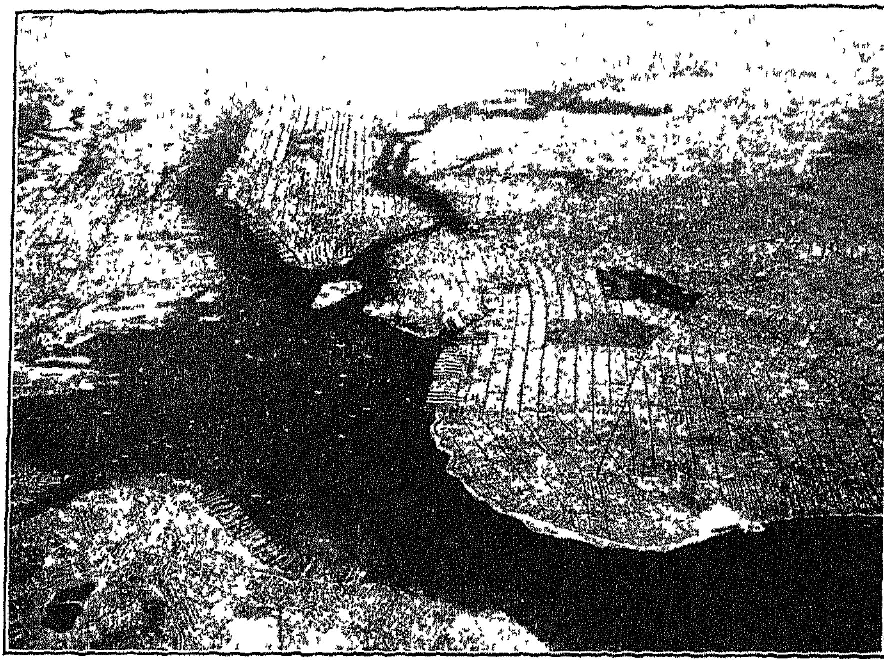



*After Goode, Philip, Atwood, Dodge, and others*

is an important one In all the large grazing areas the population is sparse, in the semi- are many people — more than one hundred and twenty-five per square mile in most

become great farmers? Why has China been called a land of "Farmers of Forty Centuries"? Why have England and Belgium been called "industrial nations"? Why do you live where you do?

**The Need for Answers.** Answers to these questions you will not have on the tip of your tongue For a long time, people failed to study the relation of a land to its people. They didn't understand the reasons for their cities or countries. Today we need a knowledge of why different peoples work as they do, why one man's occupation differs from his neighbor's, why one country's interests differ from those of another. When we have full knowledge of the needs of peoples, the world will be different from what it is today. Interests that now cause conflicts will be studied in relation to the natural environment We shall then know that certain nations cannot produce enough food, clothing, and other things because their land is too poor When we realize this, and that such nations sometimes wage wars for such reasons, we shall more readily grant favors to nations in the same way that we do to individuals. We shall know that the world is one, that every per-



*Courtesy of United States Army Air Corps, official photograph*

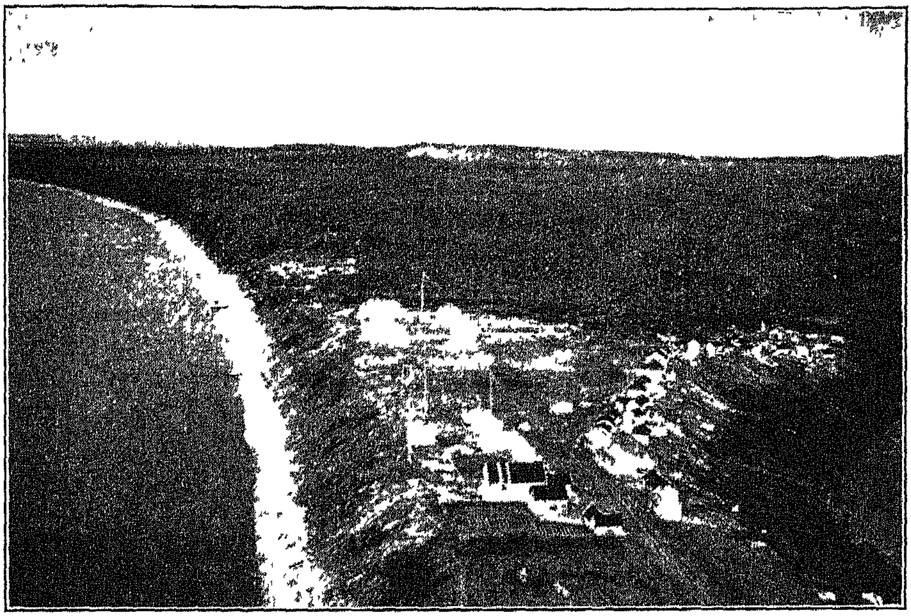
THE METROPOLITAN AREA OF NEW YORK CITY

FIG 3 This picture was taken from an airplane at 26,300 feet above the city. It shows an area with about ten million people The top of the picture is north. The financial and business district with its tall buildings and numerous piers shows in the left center.

son's, every country's interests must take account of the interests of every other person and country.

**An Important Map.** The population map (Fig. 2) gives the general distribution of people on the earth As we have seen, people are distributed quite unequally; some regions are crowded, others are not settled. In what zones do you find the most densely populated areas? What zones have the largest land areas? What zones have few people? Is the south temperate zone as densely populated as the north temperate zone? These questions suggest others. Why may one city have one million people and another only twenty thousand? Why do more than ten million people live within fifty miles of the center of New York City, while Canada, with an area of more than three and one-half million square miles, has only ten million people (Fig. 3)? Europe has an area of three million eight hundred thousand square miles and is home for about four hundred million people. Africa is three times as large as Europe but it has only one-third as many people. Asia, with less than one-third of the land area of the world, has more than one-half of the world's population. Such statements show that much of the world's area has few people.

**Where Man Lives.** With so much land available, and much of it good land, does it not seem strange that men crowd into densely settled areas? Why are there few people in northern



*Courtesy of Royal Canadian Air Force*

GOOD HOPE ON THE MACKENZIE, WITHIN TWELVE MILES OF THE ARCTIC CIRCLE

FIG 4. Good Hope is a fur-trading post where only a few people can gain a living. What can the people here do to obtain food, shelter, and clothing? Note the vegetable gardens in the foreground.

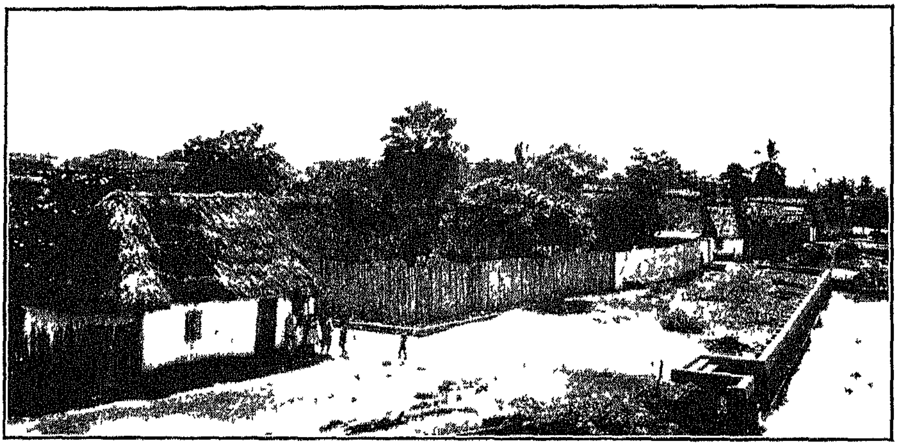
Asia? In central Australia? Northern Africa?

Four major areas stand out as the most favored by man for work and for his home. Asia has two, one including most of the Chinese and Japanese people, the other lying chiefly in India. Europe has the third densely settled area, which extends westward from Russia for more than two thousand miles to Ireland. The fourth is in North America What part of North America? These four areas have more than one hundred twenty-five people to the average square mile. They have two-thirds of the population of the world, but only one-tenth of the land surface They are regions of many occupations. Man's activities in these areas will require careful study. Notice particularly the small areas with more than one hundred twenty-five people per square mile in South America and Africa.

**Areas of Few People.** Nearly half the world has less than two persons to the square mile What continent has the smallest area of very few people? Australia as a whole, and a large part of every continent except Europe, are sparsely settled. Name eight large areas with less than two people per square mile. These areas represent the least desirable lands for man's occupations and homes (Fig 4) Yet within these lands are considerable differences in the number of people. In some of them we could travel for days and not see a single person. Can you point out any such areas? In others, small scattered settlements would be found (Fig. 5). Name places of this type In our study of economic geography we shall study the occupations

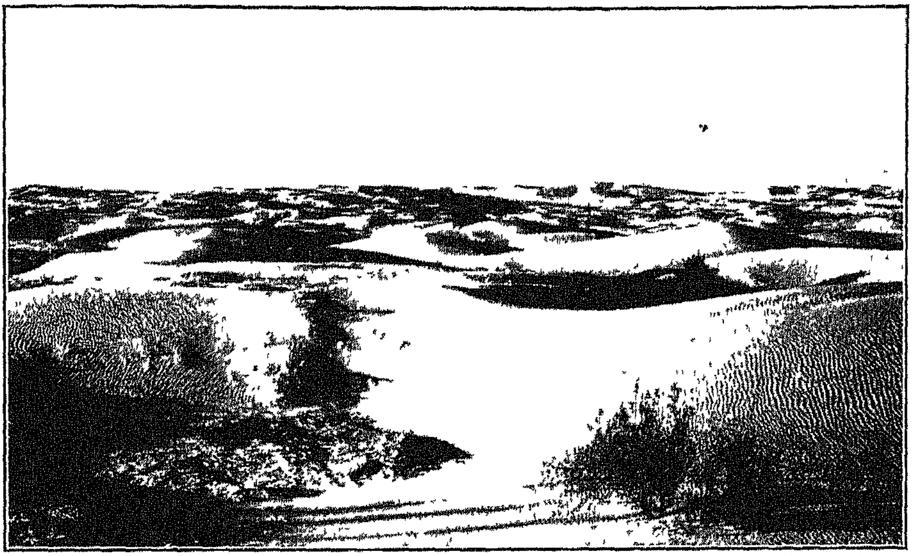
of these small settlements. They show simple and striking relationships of man's work to his land. Their study aids us in understanding more complicated regions.

**Geography Studies' Relationships.** In this chapter we have made various statements and asked several questions about the distribution of population throughout the world. Our aim is not simply to learn that the four areas of dense population are in the north temperate zone and near the oceans, our aim is to learn why this is true. Economic geography gives an understanding of different parts of the world from the point of view of occupations of man. It explains why some people live by fishing and why some grow rice and tea. It shows the relation of land surface, rainfall, temperature, plants, soils, minerals, and bodies of water to man's work. As a background for understanding occupations, we shall first study briefly the elements of man's environment in relation to the general distribution of people throughout the world.



NEGRO VILLAGE ON THE MAGDALENA

FIG. 5. In this hot rainy land, with many insects and diseases, we find few people per square mile. But nature has provided a greater variety of food than for the people living on the Mackenzie.



*Courtesy of W C Mendenhall, United States Geological Survey*

THE DESERT, SOUTHEASTERN CALIFORNIA

FIG 6 Climate is one of the chief influences on man's occupations Areas with less than ten inches of rain have very few people The lack of rain and the strong winds make life difficult here People and animals cannot survive; even the few plants are buried with drifting sands

## CHAPTER II

# GEOGRAPHIC MEANING OF THE DISTRIBUTION OF THE WORLD'S POPULATION

**Environment and Man.** Every object in the world shows some effect of its environment. The greater the intelligence of an organism, the more it feels the influences of its environment. Thus, man shows greater interest in his habitat than any of the animals; and because of an understanding of his environment man has come to be the most widely distributed form of animal life. A lordly lion taken from the savannas of Africa to the forests of Alaska would quickly die of cold and hunger; a polar bear transferred from a Greenland ice floe to the Amazon River would soon perish of heat and hunger In contrast, man is able to live with more or less comfort in regions which differ even more than those suggested above because his intelligence gives him a remarkable power of adaptation to environment not possessed by the lower animals. Despite this adaptability, men gather in areas of dense population. Clearly, men prefer certain types of land

**Elements of the Natural Environment.** In studying man's relationship to the earth, we recognize six major elements of the natural environment. They are: (1) relief or surface of the land, (2) climate, (3) vegetation, (4) soils, (5) minerals, and (6) water bodies. To assist you in recognizing these relationships we shall consider in this chapter the major elements as they affect the distribution of the world's population (Fig. 6).

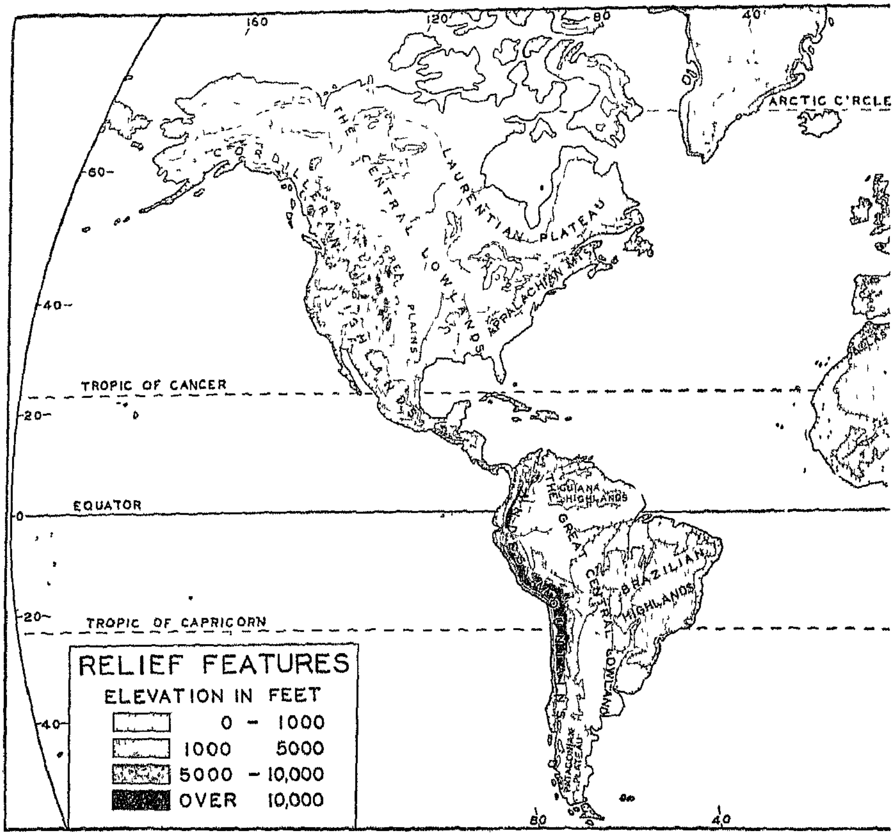
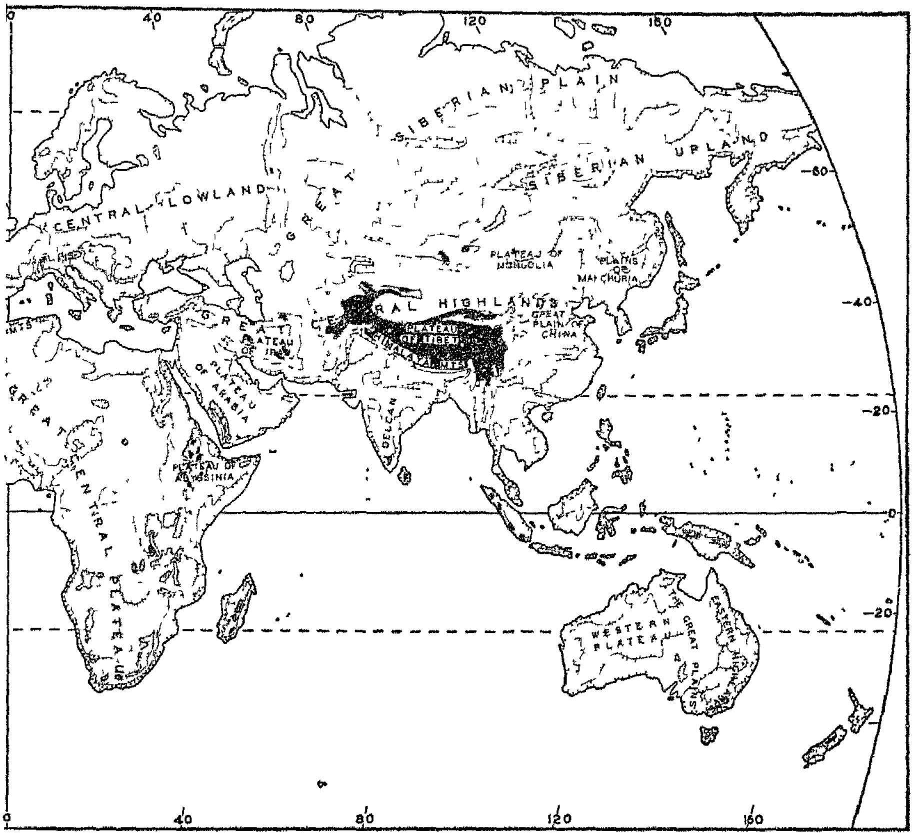



FIG 7 In our study of man's occupations we shall refer constantly to the major In what two continents are the central portions made up of mountains or plateaus?

**Relief:** *Highlands and Lowlands* Study the relief map of the world (Fig. 7). Give the names of the large plains areas of each of the continents. Compare this map with the population map Are the regions of densest populations of China and India lowlands or highlands? Of Europe? Of southern Canada? Of the United States? Of southern South America? In these areas name at least six river valleys that have many people. These relationships emphasize the value of certain lowlands and valleys as places for men to work. Why do men flock to these lowlands? Where do you find large lowlands in North America with few people? In South America? In Asia? Can you suggest reasons for this lack of population?

Locate and give the names of the large uplands and plateaus. Which continent is chiefly plateau land? What upland or plateau area in North America has a dense population? In Europe? In Asia? Name the upland and plateau areas in these continents that have few people.

Locate and name the chief mountain areas of each continent. What mountain areas in South America have many




*After Habenicht, Goode and Philip*

relief features of the world. What four continents have great central lowlands or plains? Name four great plains of Asia, three great highland areas of South America

people? In Africa? In western Europe?

You have found that men live in regions other than the lowlands In the case of lowlands, densely peopled areas lie in many latitudes. In Asia one begins near the Equator, in Europe the thickly settled United Kingdom almost touches 60 degrees N Uplands and plateaus offer a marked contrast as the centers of population. Why do the Siberian uplands have less than two people to the square mile and the Deccan in India more than one hundred twenty-five? The answer shows also why the Amazon lowlands and the Congo basin have so few people in comparison with the lowlands of southeastern Asia, northwestern Europe, and eastern United States. The answer is climate. In equatorial latitudes, an upland attracts people because its altitude makes it cooler than the lowland This stands out especially in South America, where the densest populations of the republics of Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil live in mountain areas. These statements introduce the effect of two factors of the natural environment on population distribution.

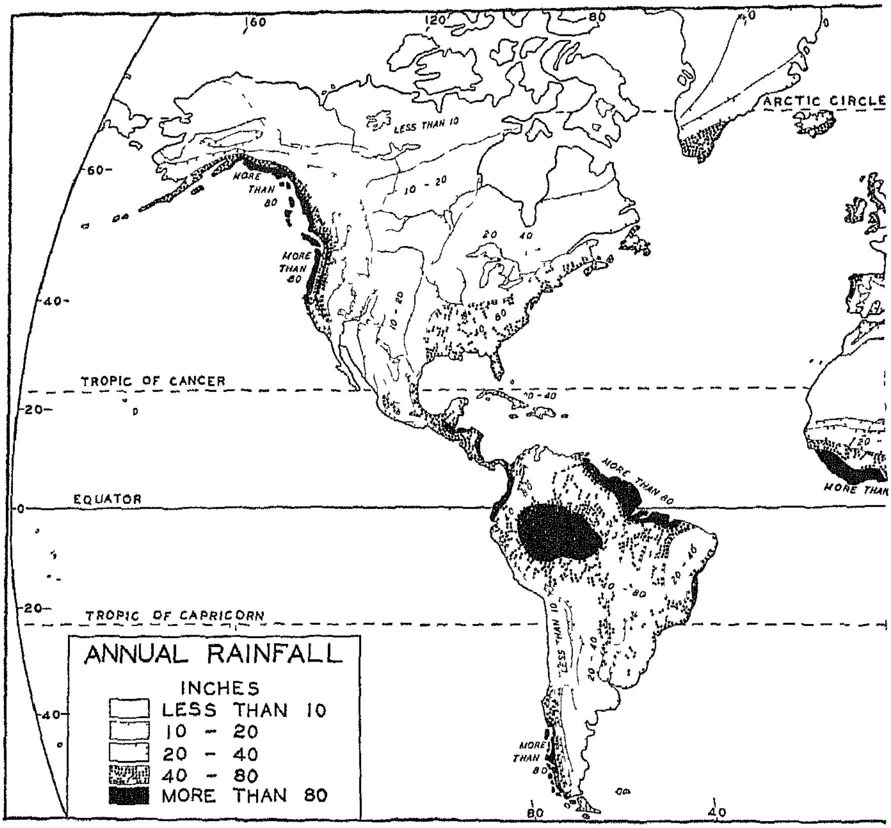
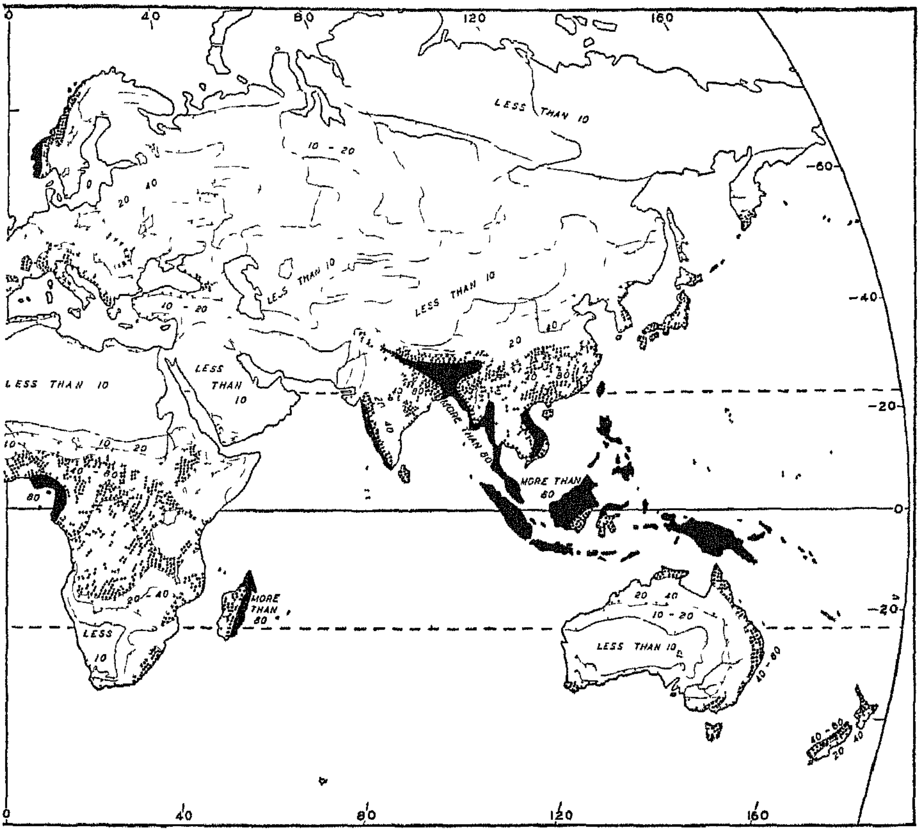



FIG 8 How many large areas are there in the world having less than ten inches of
many are there with more than eighty inches per year? Which of these areas have less
of more than eighty inches of rain per year? This rainfall map includes the precipitation

**Climate:** *Rainfall and Man* Compare the average annual rainfall map of the world (Fig. 8) with the population map Each of the leading four areas of dense settlement receives more than twenty inches of moisture per year. Does too much rainfall limit population? Lands receiving more than eighty inches per year in most cases have fewer people than those which have between twenty and eighty inches. Most of the people of the world live in regions with an annual rainfall of twenty to eighty inches. The food crops that men need most do not grow well in too wet or too dry climates, unless they are grown under irrigation

What relation exists between the rainfall and population in the plateaus and mountains of central Asia? Plateau of Arabia? Sahara? Western Australia? Western Argentina? Why does the population decrease from eastern to central Asia? Nearly one-third of the lands of the earth are too dry for many permanent settlers Most of the land where the rainfall is less than ten inches a year is without many people But there are exceptions; compare the population and rainfall maps for the following areas:




*After Goode, Philip and Bartholomew*

rainfall per year? Which of these areas have less than two people per squaie mile? How than two people per square mile? Do you find any regions of dense population in areas that falls in the form of snow

Indus Valley, lower Nile Valley, southern California, the coast of Peru Why do these areas of little rainfall have many people (p. 163)?

Compare the population and annual rainfall maps for the following areas. the Amazon basin, the west coast of Colombia, and the island of Borneo. In these areas more than eighty inches of rain, high temperature, and dense vegetation cause unhealthful conditions; white people do not wish to live there Some areas in southeastern Asia with more than eighty inches of rain have many people of the yellow race. These people seem to stand better the uncomfortable conditions and diseases that result from much rain and high temperature.

Climate: *The Effects of Temperature.* Approximately 6 per cent of the lands of the world are too cold to produce crops. Can such lands support many people? Such cold is unattractive to man and it prevents the growth of plants or animals in sufficient numbers to provide much food This is especially true in cases like the ice-capped lands of Antarctica and Greenland, or of northern Canada (Fig 9).

In lands that are always hot some

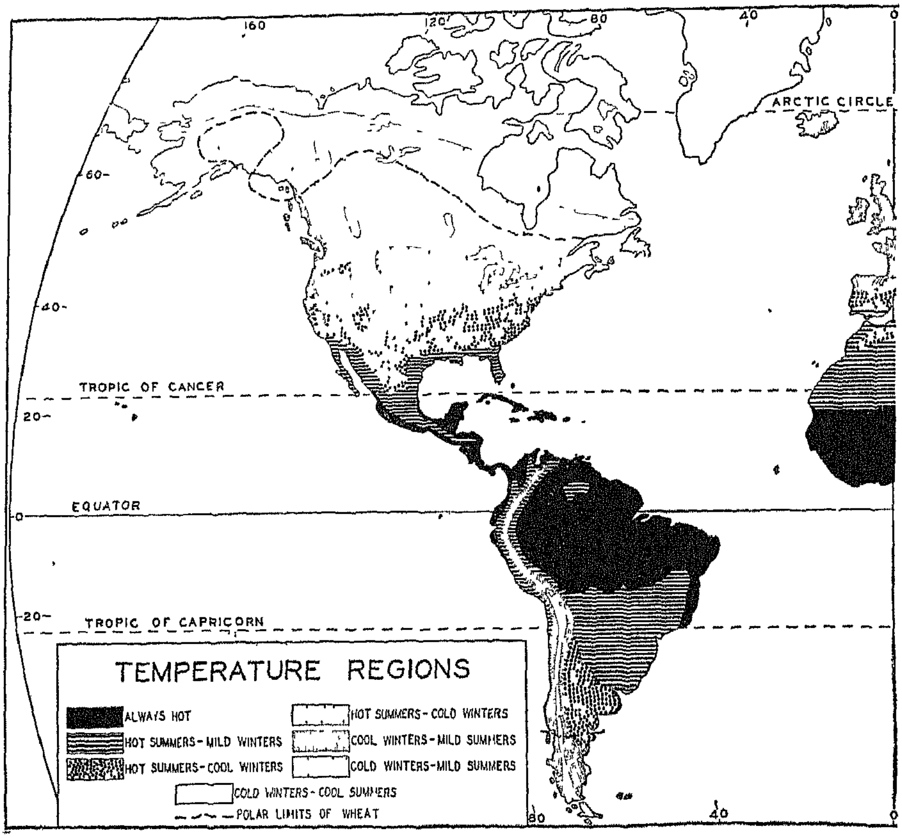
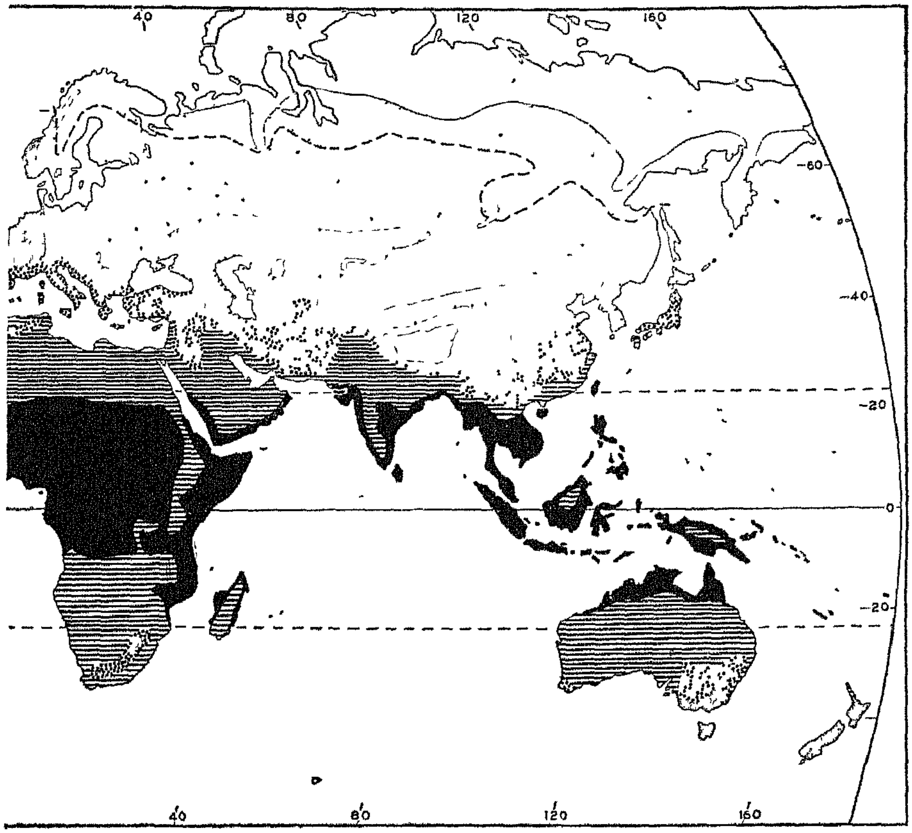



FIG 9. You need to know temperatures as well as rainfall and relief to understand are too cold for wheat, people have to depend largely on animals of the land or sea and a

areas have great numbers of people and some very few Point out examples of each Java and the Deccan of India are always hot and have many people. These people do not belong to the white race, many of them are rice farmers, they need heavy rainfall and high temperatures for their rice and other crops. Where are the two greatest areas that are always hot? Nearly one-fourth of the lands of the earth have temperatures so high that they are largely avoided by white people.

How many of the four densely settled regions of the earth are entirely in areas that are always hot? How many are in the following three areas together: cool winter and mild summer, hot summer and cold winter, hot summer and cool winter? These areas in the Northern and Southern Hemispheres include about two-fifths of the lands of the earth and have about four-fifths of the people. Yet broad spaces in these areas have few people. Point out some of them; tell why they have few people. In the densely settled belts lie the richest and most highly developed regions of the most powerful countries on the globe. These areas have changeable weather; frequent changes of winds, rainfall, and temperature, with frequent storms stimulating activity. Temperature.




*After Bartholomew, Herbertson, and Parkins*

why people live and work as they do Trace the limit of wheat production In areas that few vegetables for a living.

an excellent guide to man's activities, is not the whole cause. Every part of the earth is influenced by relief, rainfall, minerals, and vegetation.

**Relationships of Vegetation.** Plants, being living things, obviously resemble human beings in regard to some of their requirements. Plants, like men, show adaptation to types of climate. But the climates producing the best developed plants may not be those most attractive to the principal peoples The Amazon region and the Congo basin have what type of vegetation (p. 234)? The map shows one kind of vegetation which includes within its boundaries the leading populations of North America, Europe, and eastern Asia. What other factor of the natural environment does this immediately suggest? We see, therefore, that some connection exists among relatively low-lying lands, rainfall between twenty and eighty inches, moderate variable temperatures, the temperate forests, and the world's principal countries.

With a large earth to live in, why do men congregate in one main belt around the world? In ancient times, when that belt had few important peoples, there were five chief reasons They were food, shelter, clothes, tools, and means of transportation. In the

broad-leaved temperate forests man found the best combination of these requirements and a stimulating climate.

These forests contained many kinds of food: wild fruits, animals, and birds. Even today we need to go only twenty miles from large cities to gather wild strawberries, raspberries, and grapes. Forests furnished shelter and fuel. For clothes, the early man used the skins of animals. From the skins, wood, and other products of the forests, men could manufacture numerous objects. Lands with such forests had many rivers along which the forest-dweller traveled, and which furnished fish, water, and power. Truly, for primitive men the forests made a good home. So good a home was such an environment that in time the population grew greatly and the forests were cleared for crop lands.

The great grasslands of the world permitted easy travel; they could support millions of cattle and sheep and produce huge crops. Men gradually spread into them from the forests. Although fertile, the grasslands lacked the attractive combinations of the forests, chiefly because they had few materials for shelter, offered little protection against enemies, and the smaller rainfall produced fewer rivers. Therefore, men kept their centers in the forest lands as they peopled the grasslands. Today man still lives in the regions where some of the temperate forests once grew. He has cut down much of the forest and has excellent means of communication with the grasslands from which he gets much food. Compare the grasslands (p. 60) with the population map. Are the grasslands of central Asia areas of sparse, medium, or dense population? Of Australia? Of southern South America? Central Brazil? West-central North America? Of the Sudan? In the sections on soils, minerals, and water bodies, you will find additional reasons as to why certain areas have many people with different occupations.

**Soils.** Relief, climate, and vegetation all add restrictions to the types of land where men may live. Soils further limit the distribution of population, especially agricultural peoples. The great river plains of the world show how soil makes a difference even in the heart of a densely populated region. The rivers, although destructive at times, frequently renew the life of soils along their banks, as they bring fresh soil materials from their headwater districts. In the world's great areas of densest population, notice the effect of the Yangtze River in China, the Ganges in India, the Nile in Egypt, the Po in Italy, the Mississippi in the United States. In irrigated districts the decisive effect of soils is very clear. The watered soil has farms and people, the dry soil remains desert. No wonder we have the phrase, "Egypt is the Nile, the Nile, Egypt." As we draw our examples from smaller and smaller areas, the power of soils to affect population becomes more and more clear. Many a farm of a few acres proves this for it generally has a productive well-drained portion used for crops. Also, it has pasture on poorly drained or stony soils. Another section may be sandy and produce satisfactory crops only with heavy fertilization. These crops may be unusually good because sandy soils warm so quickly. On a larger scale, parts of the United States illustrate the same idea. Thus,

the productive well-drained soils of the Mississippi basin yield most of the crops The less productive, shallow, and often poorly drained soils of the northeast, as in the northern Great Lakes states and in New England, yield hay and pasture so that the leading agricultural industry is dairying On sandy soils, we find heavily fertilized truck gardens such as those of New Jersey and Long Island.

COPPER PLANT AT POTRERILLOS IN NORTHERN CHILE

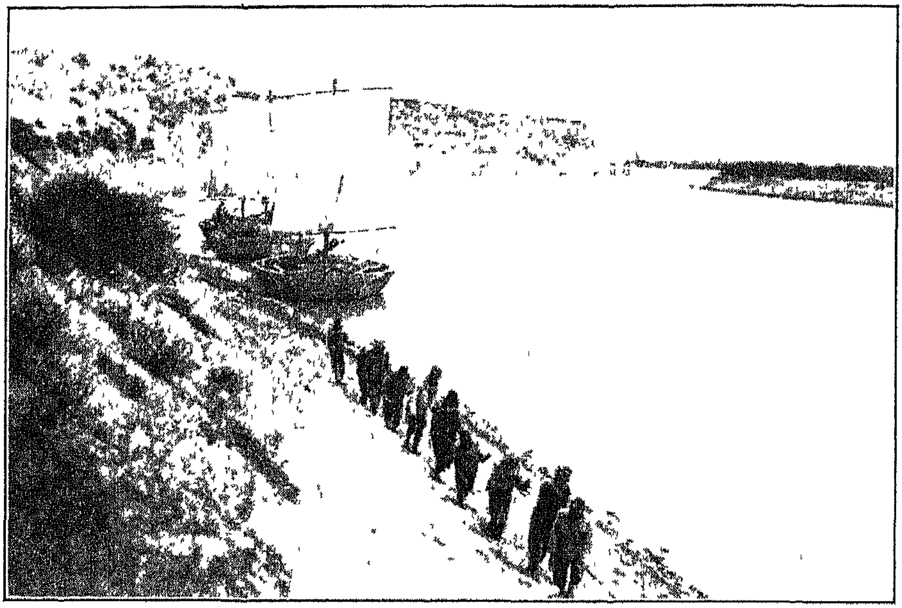
FIG 10 As at Chuquicamata, everything used in this desert mining camp comes from the outside The camp is one hundred miles from the sea, high up in the Andes, and in the center of a great desert Even with many mining camps, what is the population density of this region?

**Mineral Resources.** The effects of mineral resources on the distribution of people and their activities are of utmost significance today. Because of minerals we find people in large communities where all other features of the natural environment may be unpleasant The land may be mountainous, the climate harsh, the vegetation useless, the soils sterile, yet thousands of men will toil to secure minerals. Look at northern Chile on the population and rainfall maps (pp. 4–5) In northern Chile lie the famous copper mines of Chuquicamata, where fifteen thousand people work This district lies in one of the most barren deserts of the world Electrical power has to be brought a long way from the coast Fuel comes from California or northern Peru Fresh water is brought seventy miles in pipes from the high Andes Food is carried in over scores of miles. Laborers come from even greater distances (Fig 10) What other mineral in large quantities comes from this region (p 294)?

The products of the mines give us another reason for people living in large numbers in northwestern Europe and east central North America. These two areas produce about 90 per cent of the world's coal, pig iron, and steel — materials which encourage industry and help cause the dense population The people gained so much wealth from manufacturing that they were able to obtain sufficient food by transporting it from distant regions.

**Water Bodies and World Transportation.** Very simply we state, "they were able to obtain sufficient food by transporting it from distant regions" Yet that statement condenses many of the reasons for the great progress made by the world in the last century. The steamship, steam engine, and railroad are only a little more than one hundred years old The transportation that these inventions gave the world supplies one of the best clues ests devoted their energy to manufacturing, the people in the plains could take care of the food problem Thus arose an exchange of products on a new large scale, resulting from different geographic conditions, and forming the basis of world commerce

With this clearly in mind, look at the population map The areas of dense population lie near the sea and most of them have great rivers In other words, water bodies strikingly



*Courtesy of Wallace W Atwood*

FIG 11 UP-STREAM TRANSPORTATION ON THE YANGTZE KIANG

as to man's dense peopling of forested areas, which today cannot produce enough food to keep the inhabitants alive In addition, with the new transport facilities many men could leave their forests and venture into the open plains. If the plains did not provide materials for buildings, the forests could, because they contained not only timber but coal and iron from which many other necessities could be manufactured. So if the people in the for- influence the distribution of population.

Notice how closely the railroads of the world suggest the chief population areas. This means that the greater the means for transport, or the greater the means for exchanging products of different geographic regions, the more people. Where many people have lived for centuries in productive land and have not developed important rail systems, the areas are

not very important commercially. China has an enormous population, but a poor system of railways. The great Yangtze and Hwang Ho rivers and the many canals, while they offer means of transportation, cannot serve as well as railroads because the service is slow and undependable (Fig. 11). When famine strikes the country, thousands of people perish of hunger, chiefly because they cannot obtain food Thus we learn that transport facilities, mineral resources, soils, vegetation, climate, and relief influence greatly the distribution of people and how they make a living.

## EXERCISES

1 In taking up the activities of economic geography it is desirable to have in mind the distribution of population in each continent. Judging from our study of the relation of environmental conditions to population, what would you consider as the three areas in the Northern Hemisphere that most favor activities and modern civilization?

2. Pick out four areas of a similar type, though much smaller, in the Southern Hemisphere Would you include southeastern Brazil in one of the regions?

3. What elements of the natural environment favor man's activities in each of these areas? Refer to the text and the maps and list the elements as follows level fertile plains, a rainfall of twenty to forty inches, etc

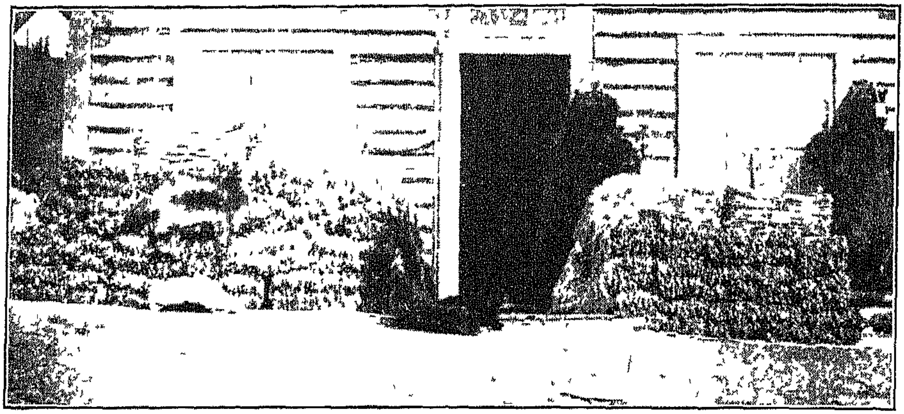
4 List the various factors that explain why nearly one-half of Asia is sparsely populated

5 In South America the great central portion and the far south have few people Why?

6. In Africa there are two broad areas with almost no people List the factors that explain the lack of people in these two areas.

7. Why does North America have two large areas with very few people?

8 Why does most of Australia have few people?



*Courtesy of National Development Bureau, Canada*

STACKS OF FURS, RAMPART HOUSE, YUKON TERRITORY, CANADA

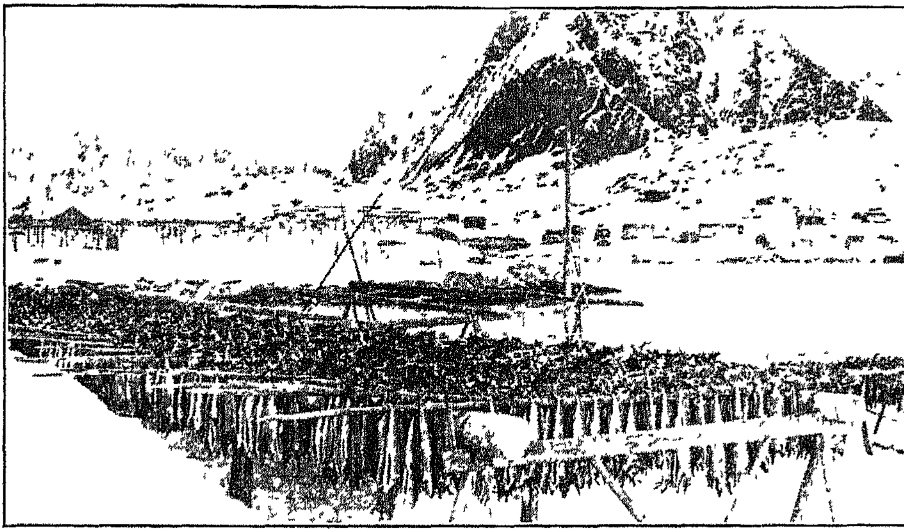
FIG 12 The furs are ready to be shipped to market in London, England The stacks contain fourteen thousand furs — muskrat, bear, beaver, wolverine, fox, ermine, etc Over all northern Canada the chief occupations are hunting and fishing What handicaps has this region that cause the people to hunt and fish?

## CHAPTER III

# THE OCCUPATIONS OF ECONOMIC GEOGRAPHY

We have seen that man lives in greater numbers in some places than in others because of the influence of rainfall, relief, and other factors We have learned also that occupations differ in various places. The occupations embraced by economic geography include eight main classes. They are hunting, fishing, grazing, farming, forest activities, mining, manufacturing, and commerce These we shall use as the plan for study. The first six are termed basic occupations, because they directly utilize elements of the natural environment. Manufacturing is related to all six, but in greater degree from hunting to mining Thus, the preparation of fish for food involves little change. To prepare iron for use requires a long series of manufacturing processes. Commerce is vital in keeping the modern world in running order. If all means of trade and transportation failed for one month, millions of people would die for want of food, water, and clothing A large city requires the products of thousands of square miles from every part of the world.

**Hunting and Fishing.** These activities are the simplest, the most widespread, and in dollars and cents the least important of the eight classes They show direct adjustment to the environment. On one hand, to hunt or fish requires a minimum of equipment On the other hand, when people follow such occupations, they generally are forced into them on account of certain handicaps of their land (Fig. 12). The fisherman has only to catch the fish;



*Courtesy of Ernest Wile and Wallace W Atwood*

LOFOTEN ISLANDS NORWAY

FIG 13 Racks of codfish being dried for the large fish-eating populations of western and southern Europe These rugged cold islands depend entirely upon the fishing industry The people living here cannot choose from a wide range of occupations

he does not even have to feed them. Three miles from shore, by international law, the sea belongs to everyone. Fishing is a dangerous life but all over the globe men risk their lives to fish for food.

The chief fishing peoples live in lands of few resources; for food they must go to sea Rough land and poor soil, as in New England and in the islands off the west coast of Canada and south of Alaska, turn the people to the sea. Norway and Newfoundland are too rough and too cold for many crops (Fig 13) Different from these examples, are the fishing industries of England and Japan There the huge population living on small islands needs all the foodstuffs obtainable and also makes it hard for men to find work on land

**Grazing.** Where people gain a livelihood from grazing, the adjustment to the natural environment also is close, but dependent on the vegetation. Grazing is a higher type of occupation than hunting and fishing The herders must supply and take care of domesticated animals in order to utilize the only plentiful food resource of their region Unable to eat grass, man uses the animals to change vegetation into food, fibers, skins, and bones

Grazing peoples contend with hardships as great as those found in hunting and fishing A primitive herder is more likely to die of starvation than a primitive fisherman He must constantly move his abode in order to avoid starvation, for his animals quickly eat the grass in any one place. Thus he becomes a nomad, always in search of green pastures and water.

These features appear even in the great cattle ranches of western United States, the pampa of Argentina, the

*Courtesy of H. G Olds*

HIGH-GRADE CATTLE, ARGENTINA

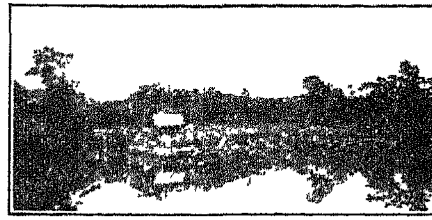
FIG 14 Uruguay and Argentina supply nearly fifty per cent of the world's exports of beef In these countries the grazing industries lead all other occupations

veld of South Africa, and southeastern Australia, where the industries in economic development are far above nomadism In many countries, grazing industries constitute one of the leading sources of commerce. Uruguay, with an area of 72,150 square miles, is one gigantic cattle and sheep ranch, devoting more than 80 per cent of the land to the grazing of cattle and sheep (Fig 14) The land can produce many crops, but the world so demands animal products that the Uruguayans, still depending upon this rather primitive occupation, are among the richest people on the globe.

**Farming.** The farming peoples occupy fertile land. Several of the most thickly settled areas of the world result from the adaptation of the land to farming. India, Japan, China, and Java show how farming supports dense populations (see Fig. 106, p. 141). Farmlands support many people because food plants, acre for acre, will nourish more people than any other type of food We eat meat because we like it and because the animals concentrate the energy of many inedible plants into the meat which we consume To make one pound of beef, ten pounds of hay and ten pounds of corn are used in the United States The pound of meat in the form of a juicy sirloin steak gives 975 calories Ten pounds of corn, as corn meal, gives 16,350 calories No wonder beef is expensive and no wonder farming areas have more people than grazing lands In eastern Asia, where half of the world's people live, the Indians, Chinese, Japanese, and East Indians are too numerous and too poor to devote their farms to the raising of animals for food. They eat the plant food directly in order to obtain its full food value.

Farming developed long after the first three classes of occupations noted above. Careful study shows farm life

to be complex. It was one of man's greatest discoveries. When men learned how to farm, they took a big step forward in freeing themselves from the dangers of their environment Farmers could grow enough food to last for a year, they escaped many of the dangers of the hunter, fisherman, and grazer, they developed permanent homes. The farmer was interested in what happened to his land and he formed agreements with his neighbors to protect his rights Such an action gave civilization a wonderful stimulus, for it led people to think of themselves as groups as well as individuals In time the formation of larger and larger groups caused trade to increase. Because they could buy products from others, farmers could begin to specialize This further encouraged trade and the size of the groups



TROPICAL RAIN FOREST BRITISH GUIANA

FIG 15 The forest Indians show little signs of progress They live from the fruits of the forest, the fish of the streams and from a few crops poorly tilled The tropical forests supply a variety of products for use in temperate lands

**Forest Activities.** Some of the peoples dependent upon forests are among the least civilized of the world At the same time forests are necessary to the most highly developed countries.

The vast tropical forests hold primitive peoples. A chief reason is the difficulty of transportation. Hot sun and heavy rains produce thick forests where vegetation grows so fast that primitive people with few tools can hardly maintain even a footpath. Hence, each small group lives by itself and provides its needs. Another cause is the amount of food in these forests. In some parts of the world people live almost wholly by collecting wild foods In such lands nature is too generous and men show little progress (Fig. 15).

The temperate forests have more civilized peoples Nature here showed itself less generous. Men had many needs taken care of, but what foods could they find in the winter when snow covered the ground? Owing to the necessity for providing food and fuel in advance the forests exerted a civilizing influence on man resembling the effects of the farm. Indeed they encouraged farming They stimulated industry What were men to do during the long months of winter? Nature provided many kinds of materials for industry, and for undeveloped peoples the forests gave the most easily utilized of all fuels — wood

As industry progressed population increased and the forests had to be cut to make room for farms and settlements Today the lands that once had magnificent forests which helped the natives to advance have lost much of the tree cover Now the important forest industries lie a long way from the cities. Generally they occupy lands too cold, too infertile, or too remote for present-day settlement in large numbers. But their relation to the original centers of forest life is closer than ever for they supply the more populous lands.

**Mining.** For a long time mining did

not make up one of the distinct classes of occupations. It represented only an adjustment of the others, it consisted essentially of gathering minerals like gold, silver, and copper to be made into simple utensils, tools, and ornaments. At that time people could not live by mining. If minerals were found near places which had been settled for other occupations, the people used the ores as they could, but their presence was not a cause of settlement.

Compare the situation today. Think of the millions of miners and the millions of iron and steel workers who depend upon minerals. Mining is now one of the most necessary of all occupations. In the United States the annual value of mineral products is practically as great as that of corn, hay, wheat, cotton, oats, and potatoes combined. It is seventy times as large as the value of a year's output of our fisheries.

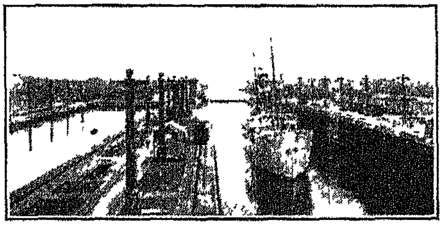
Because of the usefulness of mineral products mining is widespread (p. 284). It occurs under more kinds of natural environment than any other occupation. It hardly recognizes any obstacles. Coal miners in England work under the sea, copper miners in Peru work three miles above sea level. Tin miners in the Straits Settlements labor where the thermometer averages 80 degrees or more for the year. In the interior of Alaska the gold miners endure a winter with nights often more than 40 degrees below zero. The gold miners in the desert of western Australia receive water through a pipe line three hundred fifty miles long.

**Manufacturing.** All modern peoples need and make use of manufactured products, yet the world has only two chief manufacturing regions (p. 337). They are west central Europe and east central North America. These regions have the world's best facilities for manufacturing. These correspond closely with two areas of dense population. Originally both had forested lands which, as we have seen, encouraged industry. Both have many kinds of products. Both have transportation facilities and trade. However, in spite of all these advantages, without two minerals these regions would not be the world centers that they are. They have coal in huge quantities to supply power for the factories and iron ore to make tools, building materials, and especially supplies for transportation. Also they generate electricity from water or petroleum. Argentina affords a good example of a country lacking coal and iron. It has eleven million people, but three-fourths of the manufactured goods used come from other countries.

Manufacturing on a large scale thus appears as one of the most highly complicated occupations. It is the most difficult to start for it requires more exacting conditions than the others. When a Kirghiz sheep herder in the steppes of Asia finds one spot unsatisfactory, he and his family pack up their belongings and move with the flock. A factory, in contrast, requires much capital and must be located so that it will do business in one spot for many years. The failure of a large establishment may throw fifty thousand laborers out of work.

**Commerce.** For the development of a great manufacturing region good transportation facilities are important. Picture a giant modern plant,

equipped with every modern device of lighting, speed, and safety In it twenty-five thousand men prepare for the day's work. An airplane view shows that the factory lies near a water body and has railroads and highway connections The possibility of transportation frequently determines the location of an industry in a place where some of the original conditions may have been unsatisfactory For this reason you may see great swamps like those near New York City filled in to provide sites for factories. New York City has such fine facilities for transportation on land and sea that it pays to undertake such projects even though the initial cost is enormous (p 6)



GATUN LOCKS, PANAMA

FIG 16 Four small electric engines are towing the boat through the locks The completion of this canal rearranged completely the trade routes for many regions, especially for those in western South America and western North America

What is the function of transportation? To supply it why do men dig canals, dredge harbors, fill swamps, drive tunnels, and blast away hills? Briefly, transportation makes the earth more useful to man (Fig 16) Some regions produce wheat, others bananas, but wheat lands will not grow bananas Transportation makes possible an exchange of these products How do the eleven million people in Argentina obtain the manufactures they need? They have cattle ranches and farms of wheat and corn. England has few cattle (compared to its population) and not enough food crops, but enormous factories Argentina secures manufactures for foods, England foods for manufactures Such exchanges, effected through transportation, give us commerce on a large scale It amounts really to giving lands the advantages of geographic conditions which they may not have. It tends to leave to each geographic region the work for which it is best suited The greater this tendency, the greater the number of people engaged in transportation or commerce.

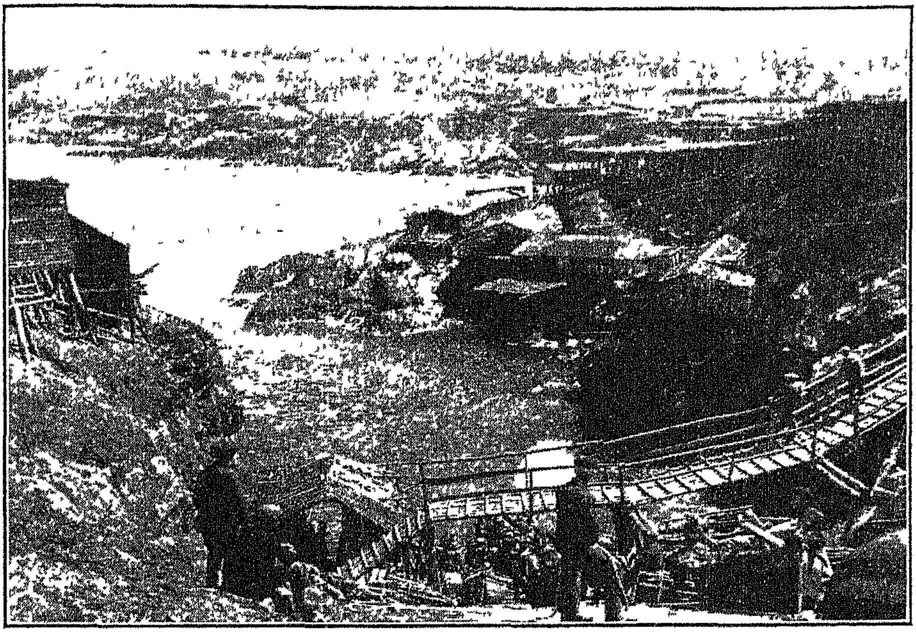
## EXERCISES

What eight classes of occupations are listed? Which are represented in your community? Locate the general area represented by the several pictures of this chapter. Upon what do the occupations in each area depend? The discussion of the elements of the environment of the previous chapter and the maps will help you. On a sheet of paper make a table including the eight occupations, as follows:

| *Occupation* | *Resources of the Environment Used* | *Products of the Occupations* |
|---|---|---|
| 1 Hunting | Wild animals, birds, etc | Meats, furs, skins, eggs, feathers. |
| 2. | | |

# PART II

# THE FISHERIES OF THE WORLD



*Courtesy of H Threlkeld Edwards, Jr.*

A FISHING VILLAGE ON THE LABRADOR COAST

FIG 17 On this cold, rocky coast the people can choose to work at few occupations, most of them fish, hunt, or farm a little Note the fishermen s huts and the racks for drying fish Note that the houses, sheds drying racks, walks, and the small fishing boats are made of wood, one of the important resources of fishing regions Locate this place on the map, page 30

CHAPTER IV

# WHY MEN FISH

**Fishing an Old Activity.** Fishing is one of the oldest occupations of man. Almost any place where men lived by the sea, rivers, or lakes they obtained food from the water Today there are fishermen in many parts of the world in lands covering more degrees of latitude than are available for any other single occupation. At the Equator, the people of the East Indies catch great quantities of fish Far beyond the Arctic Circle the Eskimos make fish one of the few main foods Far south of the Antarctic Circle intrepid sailors, mainly from Norway, pursue whales

**Wealth of the Waters.** The sea is very generous For thousands of years fishermen have caught fish Men did not have to care for the fish as they did for animals They easily prepared fish for eating, also they dried and salted fish so that they could store as much of this food as necessary for future use. Fish meant a great deal to early peoples before the world had refrigeration and transportation facilities to bring meat,

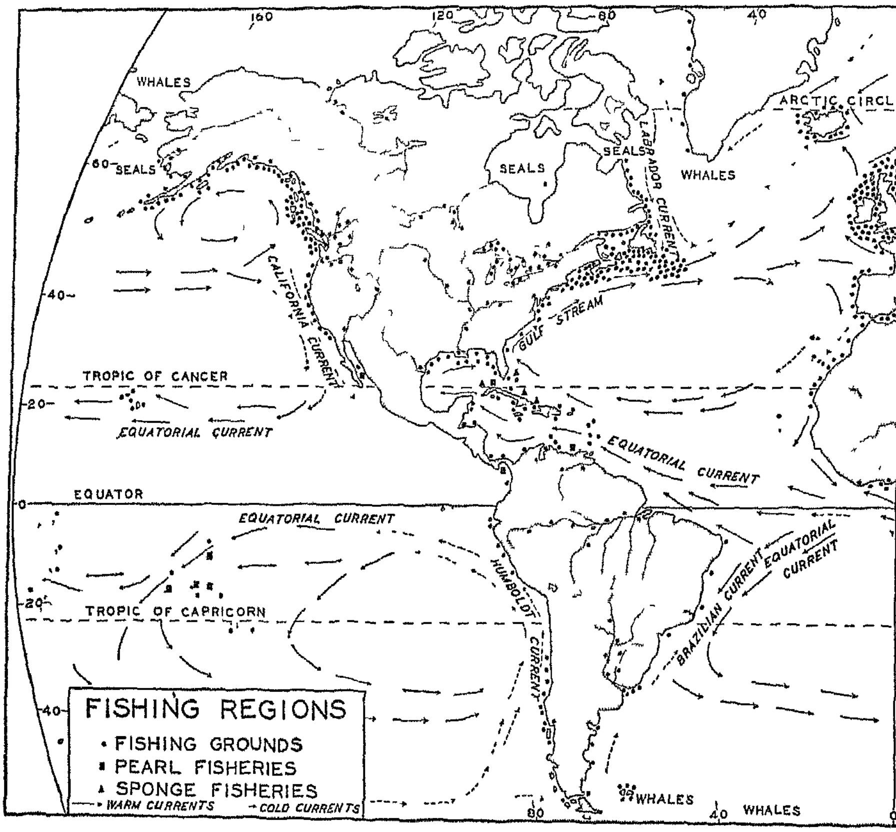
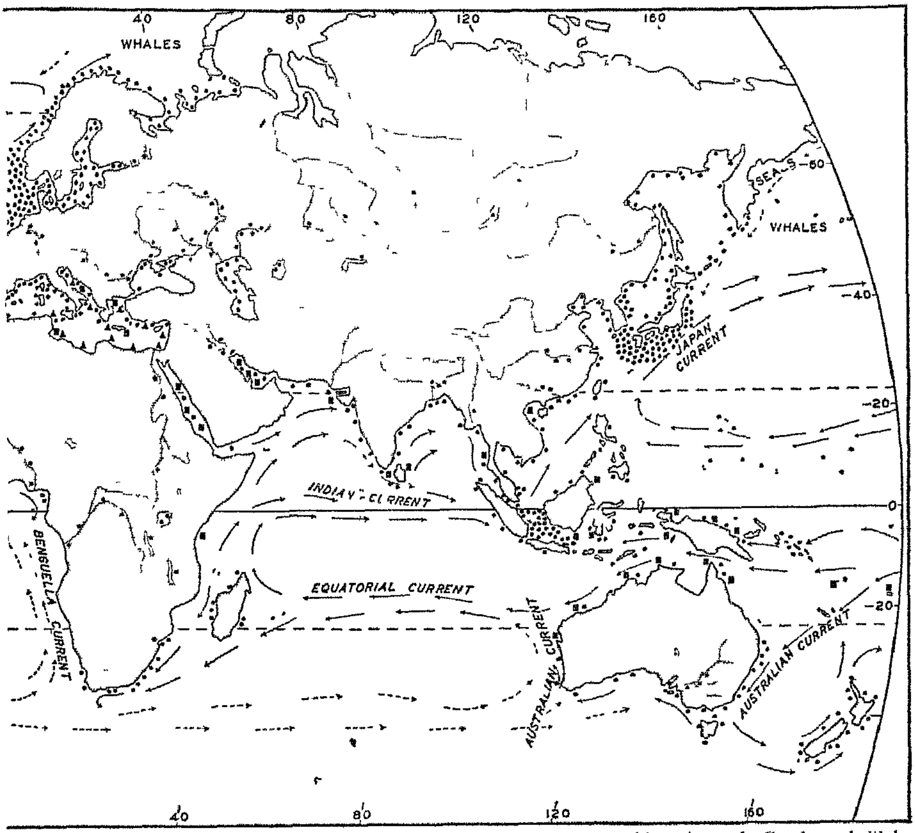



Fig. 18 Fishing is one of the most widespread of man's industries

flour, or other foods to their homes. To obtain new supplies the fishing folk often would venture far from shore. In this way they gradually discovered new lands.

**Fishing and Maritime Activity.** The best example of the way the sea drew men to new lands developed in the Mediterranean Sea which favored the early voyages of fishermen. Its comparatively small size meant that the sailor seldom lost sight of land. Its islands and peninsulas afforded protection from great storms. Largely because of these advantages, one of the peoples living on the Mediterranean, the Phoenicians, explored The knowledge of the resources of fish, lands, and people of the sea was of immense value to the Phoenicians. Because of it, in their time, they became the leading commercial nation of the world. The Phoenicians, accustomed to life in boats as fishermen, made the best and most numerous sailors. Long before Columbus was born the Phoenicians sailed through the Strait of Gibraltar onto the Atlantic as far as England.

Even today countries with important fishing industries are among the chief commercial countries. To have a merchant marine a country must have sailors and the best training




*After Atwood, Goode and Philip*

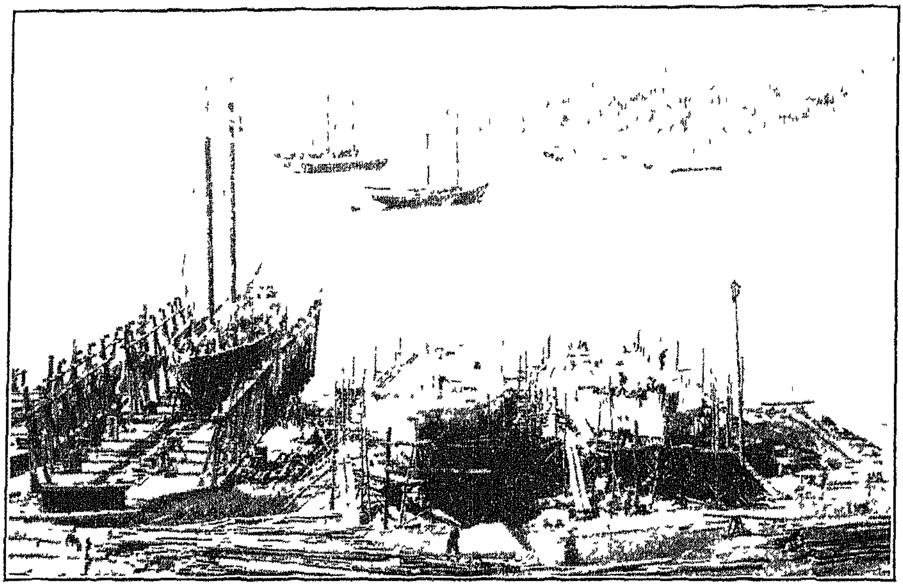
Note the relation of the great fishing regions to the ocean currents

fishing. Good fishermen and therefore good sailors are partly responsible for England's position as a commercial nation. Norway, facing the world's best fishing grounds in the North Sea, has more vessels in comparison with population than any other country. It is estimated that the boats belonging to Norway could hold all its people at one time and that one-fifth of its people are in the shipping industry. In the United States the early dominance of New England in commerce, with the introduction of the fast clipper ship, had its beginnings in the fishing industry and the conditions that favored the industry.

## BASIC GEOGRAPHIC CONDITIONS AND FISHING

We have seen that fishing dates from ancient times and that it has materially aided the advance of maritime peoples in spite of the fact that fishing is one of the most perilous occupations Fishermen endure great hardships, few living to ripe old age if they stick to fishing all their lives. In some fishing settlements the inhabitants throw flowers into the sea on Memorial Day. Why do men choose fishing for an occupation?

√**Poverty of Land.** Merely living on the sea does not always lead people to fishing as a principal occupation Men will make fishing their chief means of



*Courtesy of National Development Bureau, Canada*

SHIPBUILDING, LUNENBURG, NOVA SCOTIA

FIG 19 An important occupation in many fishing regions is the repairing and building of fishing boats On the left a schooner is being repaired and on the right two new ones are being built.

obtaining food only when they cannot find food in better ways (Fig 17). Poverty of food resources on land encourages fishing Norway has only $2\frac{1}{2}$ per cent of its land in crops and 1 per cent in pasture, Japan has 15 per cent of its area in arable land, but almost none in pasture Both the Norwegians and Japanese are great fishermen. Of Newfoundland's two hundred seventy thousand people, nearly seventy thousand are fishermen, thirty-three hundred farmers, forty-five hundred mechanics, and twelve hundred miners

**Harbors and Boats.** We have seen that the temperate forest areas of the world have fewer food resources than the tropical forests or the grasslands when under cultivation. So we should expect to find fishing a more common occupation among people in cool climates than among those in Central America The forests in themselves offer other suggestions Not only do they grow where it is cool, but generally they grow on the poorer soils, often on rocky soils in mountainous regions Suppose these mountains met the sea in great broken cliffs, what would you say as to the advantages for fishing? On the world maps of relief and vegetation find the places in the Northern Hemisphere where forests cover mountainous coasts which have numerous small indentations. They are: (1) the western coasts of the United States, Canada, and Alaska, (2) the Atlantic coasts of North America from Chesapeake Bay to northern Labrador, (3) northwestern Europe, especially in the northern parts of the British Isles and in Norway, (4) eastern Asia, in

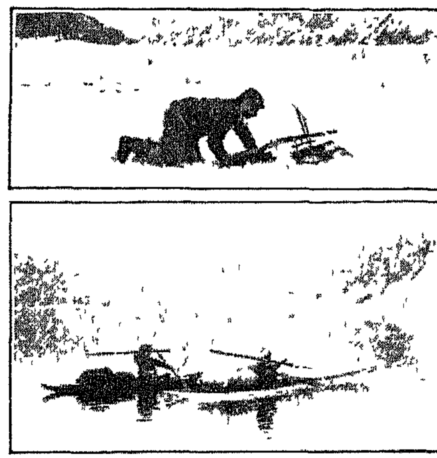
Japan, and in the mainland from Korea north. Locate these lands on the map of fisheries (Fig 18). The four greatest fisheries of the world are found in these areas because unproductive or insufficient soils drive the people to the sea, because the coasts have protected harbors, and because the forests, which impede travel inland, yield material for boats (Fig 19)

**The Fish.** Another reason explains the rank of the four leading fishing regions Luckily for these regions, which have few food resources, favorable conditions for the growth of the best food fish occur near shore

Fish food is more abundant in shallow water than in the deep sea, therefore most fish live along coasts and over shallows or "banks" in the open ocean, but not far from land. The temperature of the water makes a great difference in the character of fish life Warm waters generally have fewer fish of one kind, but more kinds, than cool waters. In New England, where fish are more used than in any other part of the United States, a large market may have one hundred varieties of sea food. In Havana the markets offer as many as three hundred fifty kinds and in Japan the housewife may choose from six hundred kinds. In cool waters the fish travel in colossal numbers in schools which is one of the most significant reasons for large-scale fishing industries. Besides, the cool waters have few poisonous or dangerous fish whereas tropical waters contain many. In addition to running in schools, some cool-water fish help the fishermen by ascending rivers in large numbers.

**Types of Fishing.** These various habits of fish and other sea life account for three main types of sea fishing. banks fishing, coastal fishing, and open-sea fishing Each of the types has considerable importance The banks fisheries, however, overshadow the others in value to man

Before we take up the geographic conditions for these types it will be instructive to consider the life of a people who depend almost entirely on hunting and fishing for their food Their way of making a living is one of

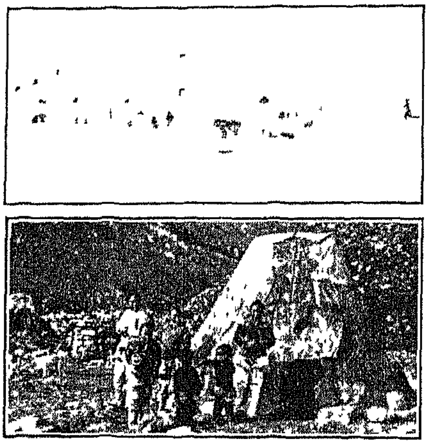


*Courtesy of Donald B MacMillan and American Museum of Natural History*

Spring and Summer Seal Hunting, Greenland

Fig 20 Hunting is the chief occupation of the Eskimos From the sea animals — seal, walrus, narwhal, bulga, and bear — the Eskimos obtain most of their food The existence of the family depends upon the success of the hunt *Upper* *Utok* hunting takes place in the spring when the seals come up on the ice through holes to bask in the sun The hunter mounts a small sail and a gun on a tiny sledge and pushes it before him until he is close enough to shoot the seal *Lower* Seal hunting in kayaks is very hazardous. After the ice melts, the Eskimos hunt the seals from kayaks with spear and gun. Note the large float made of a seal skin This float, attached to the spear by a long string, keeps the seal or walrus from getting away when struck with the spear.

the simplest examples in economic geography of the effects of animals, of sea and land, and of climate. Poverty of land explains almost their entire life. They are nomads who follow the food sources in the sea, as the Kirghiz nomads accompany their animals.



*Courtesy of Donald B. MacMillan and American Museum of Natural History*

A WINTER AND SUMMER ESKIMO VILLAGE, GREENLAND

FIG. 21. Winter villages are located on slopes accessible to smooth ice and hunting grounds and near icebergs for fresh water. Summer villages are located near water with abundant seal and safe for kayak paddling, near bird rookeries, and near a fresh-water stream from land ice. The tupik is made of many seal skins tanned and sewed and stretched over poles. The tupiks are occupied from about the first of May to the middle of October. The igloos are made of stone and covered with moss and grass. The igloos are permanent, being repaired each season before occupancy, but the tupiks are put up each spring. In a land of no trees, little grass, and so much snow, ice, and sea do you wonder that the people live largely on animals, fish, and birds?

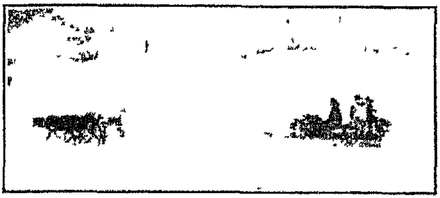
## THE ESKIMOS AND THE SEA

**Intelligence of Eskimos.** Although having a primitive type of civilization the Eskimos are regarded as among the most intelligent peoples of the globe. Indeed, unless an Eskimo is clever he does not live long. The environment makes life so hard that only the strongest and most resourceful can find food. Most of their time is used in hunting for food and clothing (Fig. 20). An Eskimo tent contains very little furniture, the people have little time for interests other than keeping themselves fed and clothed. Hence their civilization in comparison with ours seems simple and unadvanced, but this does not mean that they are less intelligent. Considering how poor a land they have, some of their tools and weapons are wonderful.

**Eskimo Land.** Nearly all the Eskimos live along the shores in arctic North America. Etah, one of the best known of their villages, lies less than one thousand miles from the North Pole. From Alaska to Greenland their land is most inhospitable. From the land they obtain caribou, musk-oxen, foxes, hares, and birds. In the short summer season the continuous sunshine makes the land astonishingly green, but during most of the year the northland is practically a frozen desert (Fig. 21). Therefore, the Eskimos depend chiefly on the sea. It gives them most of their food and most of their clothing, fuel, and tools, even their boots and the tents in which they live during the summer are products of the sea. Yet the Eskimos catch only a few fish. The mammals of the sea keep Eskimos alive.

**Importance of Sea Mammals.** Without the seal, walrus, and polar bear, life for men in this part of the world would be nearly impossible. The seal to the Eskimo represents much more than the staff of life in the

sense that we use this phrase when speaking of bread. When he goes out to hunt seal, the Eskimo uses the water-tight kayak which is made of sealskin stretched over a framework of walrus and whale bones From the animal's carcass he obtains many pounds of good meat and fat or blubber, much of which he stores for seasons when he cannot go hunting Some of the fat is used for fuel. In addition to its use in kayaks, the skin makes fine material for mittens, boots, summer coats, trousers, and tents The Eskimo's handsome and hard-working dogs also are fed largely on seal meat (Fig 22).



*Courtesy of Donald B MacMillan and American Museum of Natural History*

FIG 22 Without his dogs the Eskimo would be unable to travel from one hunting ground to another, to move his family from one village to another when food gives out, to cache quickly the meat of the seal or walrus he catches on the ice, or to kill bear, caribou, or musk ox

## EXERCISES

1 Study the map of fishing regions of the world (*a*) Where are the great fishing regions of the world? (*b*) Why are they relatively near the land? (*c*) What relation exists between the fishing regions and the population map? (*d*) Vegetation map? (*e*) Rainfall map? (*f*) Relief map? (*g*) What relation exists between ocean currents and the fishing regions?

2. (*a*) What are the basic conditions for a fishing industry? (*b*) What three types of sea fishing are there? (*c*) Which is the most important? Why?

3. (*a*) In what ways does their environment make the Eskimos "eaters of raw flesh"? In a brief statement give the character of their environment (*b*) Explain the relation of the environment to their method of fishing and hunting The map will help you. (*c*) What land animals do Eskimos use? (*d*) What sea mammals are important to them? (*e*) In what ways do they make use of the seal? (*f*) Why are there no Eskimos in the Southern Hemisphere?

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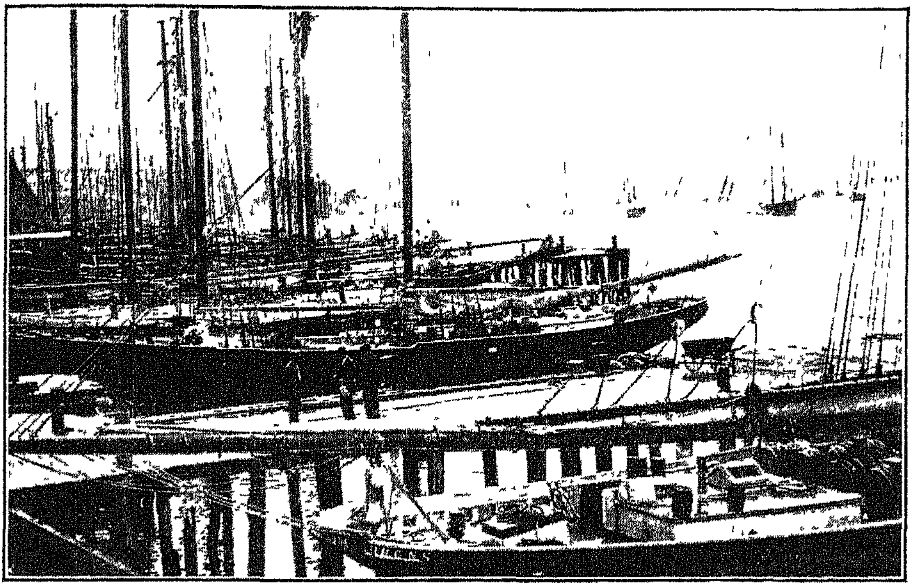


*Courtesy of National Development Bureau, Canada*

FISHING FLEET, LUNENBURG, NOVA SCOTIA

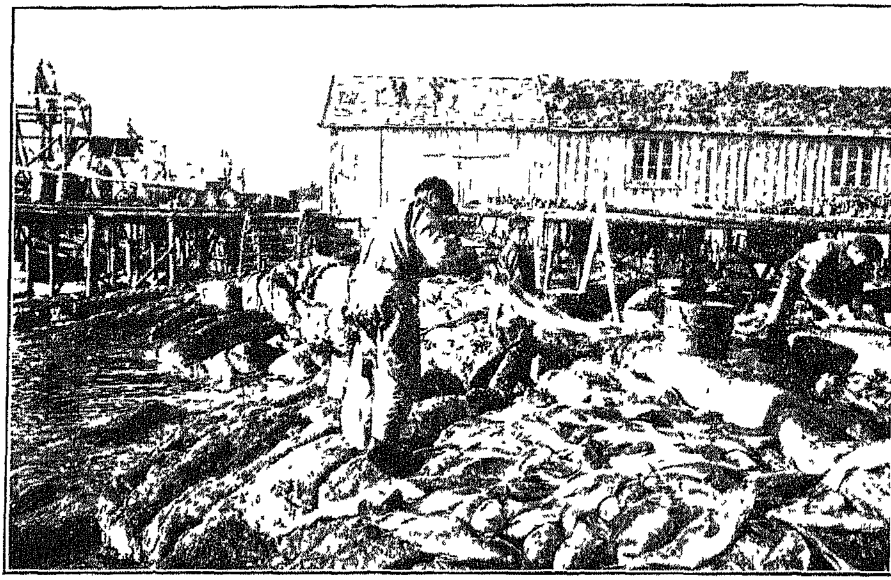
FIG 23 On the map on page 39 find the banks to which these schooners go for fishing How far may they travel? What would be loaded on the boats before they sail for the banks?

## CHAPTER V

# THE BANKS FISHERIES

**Characteristics of Banks.** What are "banks"? In general, those parts of the ocean less than one hundred fathoms (six hundred feet) deep belong to the banks The greater part of such depths lie near continents, they indicate an underwater extension of the continental land mass, and are known as the continental shelf

What does this mean to fish and to the economic geographer (Fig 23)? 1. The banks lie near land, so people do not have to go far to fish 2 The banks lie near the mouths of rivers and fish on the banks obtain much food from them. 3 Conditions in such areas greatly favor the growth of the plants on which smaller sea animals live, the plants require both sunlight, which does not have much power deeper than six hundred feet, and certain chemical elements brought by fresh water from the land 4 As the larger fish, such as men eat, feed on the smaller fish which in turn feed on the vegetation of the sea, the parts of the ocean with best conditions for plant life will have most large fish. We find the best conditions in the cooler parts of the sea On p. 30 point out the major banks fisheries 5. Fish congregate in millions to feed on the banks of the higher latitudes.



*Courtesy of Encret Wilse and Wallace W Atwood*

FIG 24 CODFISH, LOFOTEN ISLANDS

Three other important reasons explain man's greater development of the banks of the higher latitudes: 6. The few food resources of many of the coasts. 7. Fresh fish spoil very quickly in warm lands When an Indian on the Amazon River or on a tropical island catches fish, he must eat them within a few hours or immediately preserve them. He cannot go out to sea for several days and continue taking fish In cool climates, fish keep better and vessels may stay at sea for days while the ice which they carry keeps fish in good condition 8. Europe and North America contain millions of people whose religion compels them to eat fish on many days.

**Banks of Northwestern Europe.** Nearly half of the fish caught for market in all the Atlantic comes from the banks of the North Sea. Here the fishermen from the British Isles, France, Belgium, Holland, Germany, Denmark, Norway, and Sweden for centuries have reaped a rich harvest of sea life.

In conditions favorable to a fishing industry, the North Sea has no equal. In few places over its area of one hundred fifty thousand square miles does its depth exceed six hundred feet. The average depth is only three hundred fifty feet. Its best part, the famous Dogger Bank, has water only between fifty and one hundred feet deep. Land almost surrounds the sea, so that many large rivers bring much fresh-water food. Many kinds of fish abound in enormous schools. About nine-tenths of the catch are herring, cod, and haddock The climate of all the adjoining coasts favors preservation of the catch, the natural ice of Norway still being used in large quantities The coasts have an abundance of small harbors and their natural vegetation includes many trees suitable for sea craft. The land is unable to support the people, thus encouraging fish-

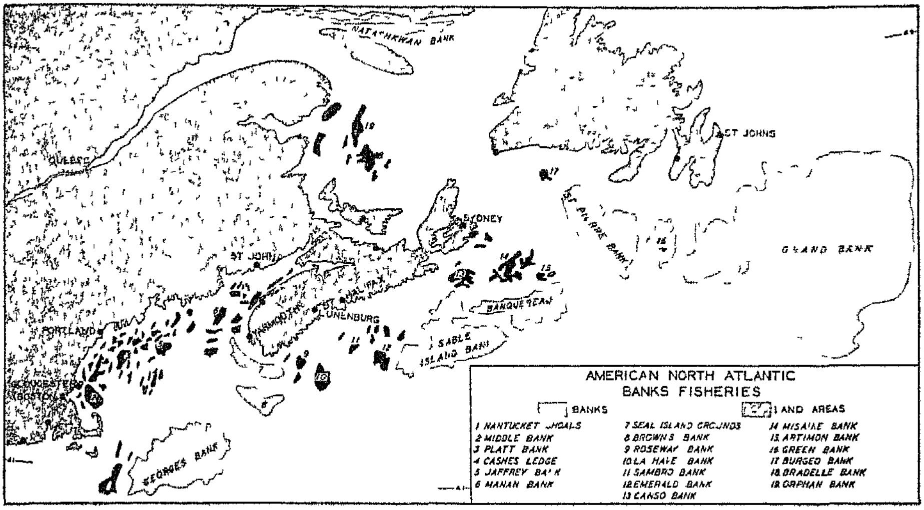



FIG. 25. The smaller banks are shown in black What are the chief fishing ports of this region? What two ocean currents cross this area? How dense is the population in southern New England? What mountains and plateaus nearly reach the sea here? What kind of summers does this region have?

ing, and the huge population of northwest Europe constitutes a fine market for a large-scale industry.

Great Britain, owing to its favorable location and its large population, accounts for more than half of the huge catch. A hundred thousand men are required to man the British fishing fleets of a variety of craft. Great Britain has more stream trawlers than all other countries combined To handle the enormous catch many ports have developed elaborate facilities. The most important, and it is the greatest fish market in the world, is Grimsby, this town lies only one hundred miles from the rich Dogger Bank. Other ports with large fishing activities are Aberdeen, Hull, London, Lowestoft, Yarmouth, Milford, and Fleetwood

The North Sea has only part of the fisheries of northwestern Europe. The Baltic Sea offers much shallow water for fishing. The whole coast of Norway has valuable fisheries. Norway has such scant population, and such rich fisheries that it annually exports two-thirds of its fish products. The banks about the Lofoten Islands have an important codfish industry (Fig 24) Every spring thousands of people go to these islands to help catch the teeming cod About half of the people catch fish, while the remainder, mostly aged folk, women, and children, clean the fish, salt them, and lay them on the rocks in the sun to dry South of the Lofoten Islands stretch many herring fishing grounds. About Stavanger centers the world-renowned Norwegian sardine industry. The Faroe Islands and Iceland have valuable banks.

**Banks of Eastern North America.** While they lack some of the advantages of the European banks, the fisheries of New England and the Maritime Provinces of Canada are important. On the Grand Bank southeast of Newfoundland fishermen gather from the United States,

FIG 26 CODFISH DRYING, DIGBY, NOVA SCOTIA

Canada, and many countries in Europe. The banks between the latitudes of Nantucket and the eastern coast of Newfoundland have the world's greatest codfish industry (Fig. 25).

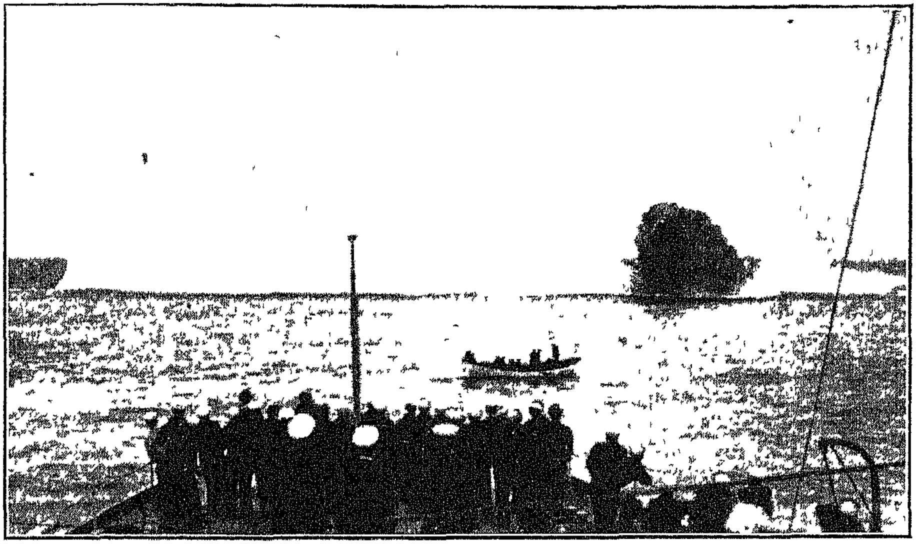
The relationship of land and sea resembles northwestern Europe. The banks have an area of about seventy thousand square miles, more than half of this is in the Grand Bank. The banks are smaller than those of the North Sea. Many rivers, including the St. Lawrence, assure the fish a supply of fresh-water food, the coast has innumerable small indentations. Conditions of climate and natural vegetation add to the advantages for fishing. The coastal lands are even poorer in food resources than northwestern Europe. Newfoundland and Labrador depend almost entirely upon fish for a food supply.

But these banks do not lie near so huge a population as that of Europe. Besides, many of the near-by people, especially in the United States, are wealthier than those across the sea and can afford to eat a greater variety of foods. Therefore, these fisheries do not produce so much in value as those in Europe. What are the leading fish ports in this area?

The banks of North America furnish chiefly cod, haddock, mackerel, halibut, and hake. If you live in New England or the Maritime Provinces of Canada, you know which of these is most important. The first settlements in America were aided by the wealth of codfish in the nearby waters. Think of the name of Cape Cod.

As the cod grows best in cold waters, the fish abound in the more northern banks. The fishermen of Newfoundland and Labrador, therefore, take more cod than all the others of these banks. Huge quantities are dried in the sun and sent to many parts of the world (Fig 26).

Cod-fishing on these banks is one of the most dangerous of occupations.



*Courtesy of United States Coast Guard*

BLASTING AN ICEBERG THE INTERNATIONAL ICE PATROL ON THE GRAND BANKS

FIG 27. These huge bergs are a menace to the fishermen as well as to ocean ships The small boat is like a dory in which the fishermen work as they take the fish from trawl lines The sea was very calm when this picture was taken

The perils lie in the natural conditions of the water over the banks and in the methods of fishing, particularly on the Grand Bank In addition to being one of the stormiest and foggiest regions of the world, the Grand Bank is crossed by the busiest steamship routes In the dense fogs, the gigantic transatlantic liners frequently demolish the small fishing craft and the fog prevents the rescue of the luckless fishermen. Icebergs are another menace (Fig. 27) The type of fishing adds to the danger

Two methods are used in fishing on the banks — by schooner and dories and by steam trawlers After the schooner anchors on the banks, two men go out in a dory. Each dory has a "trawl" half a mile or more in length to which shorter lines with hooks are attached The crew of two lets out the trawl, the hooks having been baited in the schooner, and passes the day removing fish and rebaiting the hooks. The trawl is held on the top by floats, the lines sink to the bottom At night, or when the dory is filled with fish, the men return to the schooner and prepare for the next day's work. It is hard work. Many fishermen use a trawler, a boat with engines and larger than a schooner Powerful trawlers drag a huge net along the bottom until filled with fish, then it is drawn up and the fish are taken out and packed on ice. Trawlers can fish only on sandy banks. Why? Schooners and trawlers stay at the banks for days and weeks.

**Banks of Eastern Asia.** One of the countries in eastern Asia has more than twice as many fishermen as the United States, Canada, England, and Norway combined These one and one-half million fishermen have three hundred sixty thousand boats, yet less than one hundred of the craft are

steam trawlers The people in this country eat three times as much fish per person as do those in the United States Recall now the factors of the natural environment which lead people to make fishing an important occupation What country is this where fishing means so much?

One can hardly picture Japan without thinking immediately of the sea The extension of Japan through thirty-five degrees of latitude, the shape of the empire, thousands of islands, long coast line, and rough lands bring a large part of the people in direct contact with the sea. If you spent a vacation anywhere in Japan, you would think of the sea at practically every meal Japanese farmers cannot afford to devote their tiny farms to the raising of animals To feed so many mouths, crops must occupy as much of the land as possible. This is a small area in mountainous Japan For meat, sixty million people depend primarily upon the sea Without it, Japan could not support its people and it could not have become a powerful commercial nation

The waters about Korea, the Kurile Islands, and Sakhalin contain the best fishing grounds, but the hardy fishermen in their small vessels seek fish for thousands of miles northward along the coast of Asia The more important fish are cod, herring, sardines, and mackerel Besides these, Japan consumes great amounts of fish that do not frequent the other principal banks fisheries of the world These species, especially the bonito, which is related to the tuna, and the yellowtail, come to Japanese markets because of the nearby waters of the warm Japanese current.

In Japan more than in any other country fish provide food in two ways. Besides the usual method, fish add to the food supply by enriching the soil. The Japanese save every scrap of fish refuse and use many inedible fish to fertilize their farms In this way they have maintained for centuries the productivity of their lands.

## EXERCISES

1 (*a*) What are banks fisheries? (*b*) Where are the chief ones? (*c*) Why do fish congregate by the millions to feed on the banks of higher latitudes?

2 (*a*) From the maps, pictures, and text list eight factors that make northwestern Europe a great fishing region (*b*) What per cent of the land of Norway is in crops (p. 32)? (*c*) In pasture (p. 32)? (*d*) Why are one-fourth of the people of Newfoundland fishermen? (*e*) Why do fishermen choose the shallow waters for fishing? (*f*) What fish are caught here?

3. Study the map of banks of North America. (*a*) How do they differ from the banks of the North Sea? (*b*) Answer the questions under Figs. 23 and 25. (*c*) What fish are caught here? (*d*) Why is fishing on the Grand Banks a perilous occupation? (*e*) Explain how fishing is done by dories. By trawlers.

4. Prepare a talk on fishing with a schooner on the Grand Banks; include the preparation for the trip, the trip to the banks, the catching of the fish, and their preparation until the ship returns to port

5. (*a*) What conditions bring a large part of the people of Japan in contact with the sea? (*b*) Why do so many people of Japan have to turn to the sea for a living? (*c*) Why does Japan have few animals? (*d*) What part of Japan can be used for farming — arable land

(p. 32)? (e) Where are the chief fishing grounds? (f) What fish are caught?

6 Now write in outline form all the physical and economic factors that favor the great development of the banks fisheries. Why are there no great banks fisheries in the Southern Hemisphere? To answer this question fully consider both the physical and economic conditions presented by the maps you have studied.

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*Courtesy of Reginald Orcutt and* Travel

SORTING SARDINES ON THE COAST OF PORTUGAL

FIG 28 Why should this region have an important fishing industry?

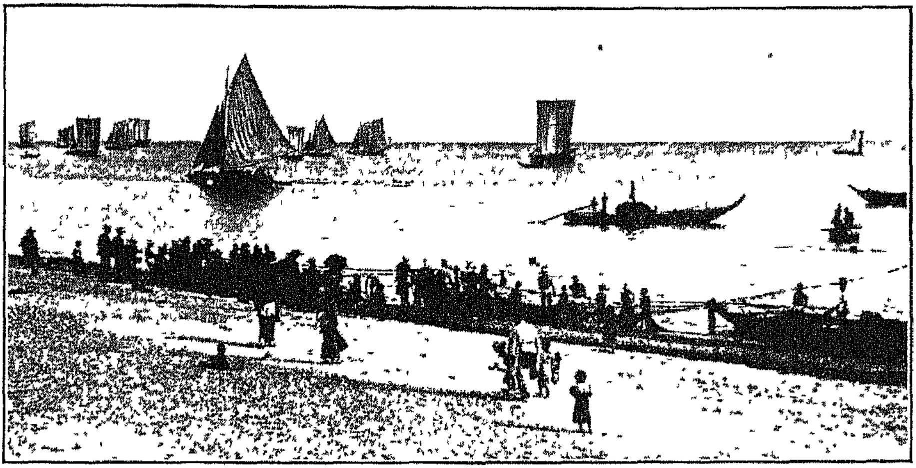
## CHAPTER VI

# COASTAL AND FRESH-WATER FISHERIES

The sea is especially generous near its shores. Every mile of seacoast has some fish Wherever people live on coasts we find fishing The industry may not be large in places where the land is productive, but even here the inhabitants devote a little time to fishing for a change in food or for sport Where fish abound large industries have arisen such as the salmon industry

Two habits of fish explain the great value of the coastal fisheries In studying the banks fisheries we discovered the significance of shallow waters, cold currents, and food resources brought from the land. These attractions cause many species of fish to spend much time cruising near shore. In New England great quantities of cod, haddock, halibut, mackerel, and herring are caught in shallow water Certain species of fish live largely in the sea but ascend fresh-water streams to spawn. This habit gives us the valuable salmon and sturgeon (chiefly in the Volga basin) industries and several lesser ones including the alewife, smelt, and shad At times the fish swim upstream in such numbers that they virtually trap themselves Salmon deteriorate as they ascend the rivers, when they reach spawning grounds they are useless for food. Therefore they must be caught near the mouths of rivers.

Coastal fishing differs greatly from banks fishing It has comparatively little danger, for the fishermen seldom lose sight of land. In addition, quantities of fish are caught by traps, wheels, or set lines. Weirs, large traps,



Courtesy of Wallace W. Atwood

FISHING ON THE SHORE OF JAPAN

FIG. 29. The people on the beach are pulling in a net filled with several kinds of fish. Sailboats are coming in after a day of fishing.

into which fish may swim but rarely leave except to go to market are common on many coasts. Traps, one of the most important devices for catching fish, are very destructive.

**Sardine and Tuna Fisheries.** The catching of sardines and tuna (tunney) has been important for thousands of years (Fig. 28). To catch the tuna many expeditions of the Phoenicians and Greeks to many parts of the Mediterranean and Black seas were made. These fish furnish the most dangerous kind of coastal fishing, but as they live in the warmer or less stormy regions of the ocean the fishermen do not suffer hardships like those of the banks fishermen. The world's best sardine and tuna fishing grounds lie off southern California and the coasts of western Europe, in the Bay of Biscay, the Atlantic, and the western Mediterranean. Does the name of the Island of Sardinia suggest anything to you? Fish packed as sardines come from many colder areas but in reality the cans contain many species which are not sardines. Japan has a huge industry of this type (Fig. 29).

In the United States the sardine industry started in 1875. It has grown so rapidly that now this country produces nearly half of the world's sardines. The fish come chiefly from the waters off northeastern Maine and southern California. Maine sardines are really young sea herring. The coasts of that state are studded with thousands of weirs used to trap these fish. The California fisheries have the pilchard, a fish like the French and Portuguese sardine. Here the fish are caught in huge nets laid out about a school of fish near the surface. Single hauls have contained as many as one hundred tons of sardines. California sardines account for half of this country's output.

Tuna fishing is found chiefly in the Mediterranean Sea and off southern California. In the California waters the blue-fin tuna and yellow-fin tuna may weigh as much as six hundred

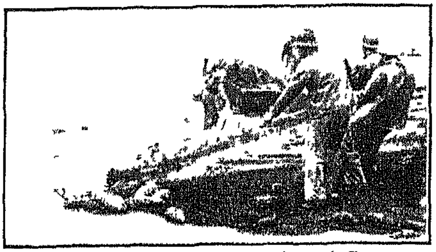
pounds In the Mediterranean they sometimes top one thousand pounds In California tuna fish are taken with strong hook and line and purse seines Many vacationists go tuna-fishing because of the thrilling fight which the huge fish give when hooked.

The canning of sardines and tuna makes these fish particularly useful. Canned sardines go to all parts of the world Besides furnishing food to the fishermen and distant people, the fish give employment to thousands of workers on shore In the United States the value of canned sardines and tuna exceeds $25,000,000, a sum twice as large as the value of all fresh fish landed at the three leading fishing ports of the Atlantic — Boston, Gloucester, and Portland

**Salmon Fishing** If all fish had the habits of the salmon, fishing would lose much of its danger and would attract many more people Like the alewife, shad, and smelt, the salmon gives man one of his most easily gathered foods. The fish always return when full grown to the river where they were born Fishermen merely have to wait until the fish return So easy is the catch that without regulation by the government the market would be oversupplied and the fishing would quickly become unprofitable.

The salmon is a cold-water fish. The important salmon fisheries lie in the northern Pacific, the American along the coasts of western United States, Canada and Alaska and the Japanese along the coast of Siberia, chiefly about the Amur River.

For a long time salmon fishing has been a leading industry in northwestern North America In early days nearly every river north of San Francisco had its "runs" of salmon. At



*Courtesy of Portland Chamber of Commerce*

CATCHING SALMON, COLUMBIA RIVER, OREGON

FIG 30 The Columbia River is the chief stream in the United States for salmon fishing What other streams along this coast are important? When are salmon caught?

present few rivers have commercial "runs", overfishing has caused depletion, dams are a menace, fish ladders are a joke; stream pollution is destructive. The biggest supplies are in British Columbia and Alaska The Alaskan salmon industry accounts for three-fifths of the value of the territory's exports. For the native Indians the salmon is even of greater significance, since they depend almost wholly on this fish for food, smoking and storing large amounts during the "runs" from May to October.

If man did not know how to can or cure fish, the salmon industry of North America would not have become so important The nearby lands have small populations and the best fishing areas lie in rocky and cold districts generally unfit for settlement. The tin can, however, has made salmon the prime commercial fish of North America. The coast has numerous canneries, usually located near river mouths; to them thousands of workers come in the spring when the "runs" start. The fish are caught by several kinds of nets, traps, and fish wheels (Fig. 30). The wheels, common in the swift streams, make

fishing easy.[1] The force of the stream turns the wheels and the wire baskets drop hundreds of salmon, some weighing fifty pounds, into a boat anchored below. Some of the fish go to market fresh, but the majority go to canneries. Although open for only a few weeks each year, canneries in the United States and Alaska put up $50,000,000 worth of salmon. Salmon canned in Alaska, the United States, or Canada is known all over the world.

**Tropical Fisheries.** In tropical lands fishing nowhere has reached so advanced a state as on the banks of the northern oceans. Nevertheless, tropical peoples eat quantities of fish, much of it caught locally by crude methods and a great amount imported from the banks fisheries.

Many environmental factors tend to retard fishing in low latitudes. The climate helps fertile soils yield so much plant food that the need for fish is not felt. Moreover, high temperatures make it difficult to keep fish. The climate certainly does not encourage the hard work which accompanies fishing on a commercial scale. Too easy a life, such as exists in parts of the tropical lands, kills incentive. Thus the people of many warm lands have failed to develop boats capable of staying at sea for long periods.

Despite these handicaps, tropical peoples do fish in the sea, generally near shore. Many fishermen ply their trade in southeastern Asia, especially in the Dutch East Indies and the coastal waters of the great deltas of the Song-ka, Mekong, Irrawaddy, and Ganges rivers, and around the islands of the Pacific. All of us know of the skilful fishermen of the South Sea Islands who use only a spear for tackle. Besides, these lands buy large quantities of preserved fish. The port of Singapore in British Malaya, an importing point for a large area, each year receives more than one hundred twenty-five million pounds of dried and salted fish. Why do these peoples catch and import fish in the face of the many handicaps? Anyone who has lived in the Far East or in the low latitude islands of the Pacific could quickly answer. He would tell you what fish means in a land where meat is scarce, either because there are too many and too poor people to give the land to animals or because the climate does not favor them. Fish and rice correspond to your meat, potatoes, and bread.

**Fresh-water Fisheries.** The rivers of the world play an important rôle in the fishing industry. The fresh water they bring to the sea is vital to the growth of the plant life which largely supports fish; the tremendous amounts of organic materials which they give to the sea add to the food supply of fish. The lucrative salmon industry depends on rivers. Moreover, the rivers are the only habitat for many kinds of valuable fish.

Among less advanced people, rivers are a leading source of food. Most of the American Indians caught the food fishes of the rivers and lakes. In South America the Indians and other people of the lowlands devote much time to fishing in the rivers. In Africa the abundance of fish in many rivers, as well as the fertility of the soil, accounts for numerous large villages. The rivers of southeastern Asia have

[1] In Alaska gill nets take 25 per cent of the fish, purse seines 20 per cent, and traps more than 50 per cent; in some places the use of wheels is prohibited by law.

*Courtesy of Japanese Tourist Bureau*

CORMORANT FISHING FOR TROUT, NAGARA RIVER, JAPAN

FIG. 31. The cormorant fisherman handles from six to twelve cormorants on strings attached to the birds' necks. The bird dives for and captures the fish, which stays in the gullet because of a ring placed around the bird's neck to prevent the fish being swallowed. Each bird may catch one hundred or more fish an hour, if fishing is good. How does this picture help you understand the importance of fishing in Japan?

fresh-water fisheries many times more valuable than some of those about their deltas.

One of the world's foremost fresh-water fisheries lies in the Great Lakes although compared to the ocean fisheries it does not seem very significant. Whitefish, trout, pickerel, and lake herring are as familiar to the people of the Great Lakes region as cod, haddock, halibut, or mackerel to those in New England. The United States and Canada yearly produce more than $10,000,000 worth of fresh-water fish.

In Europe the principal fresh-water fisheries are those of Russia, where the large rivers like the Dnieper, Don, Volga, and Ural still have many fish even after years of over-fishing. Caviar, made from the roe of the sturgeon, is the best known fish product of this region and has world-wide fame. Like several other species in these rivers the sturgeon actually comes from the Black Sea and the Caspian Sea.

Possibly the most valuable fresh-water fisheries in the world belong to China and Japan (Fig. 31). In a region having so many people, fish have extraordinary importance. Not only are enormous quantities taken from the rivers, but the Chinese lead the world in fish farming, raising millions of pounds of goldfish and many kinds of carp in small ponds.

## EXERCISES

1. (*a*) Where are the great sardine and tuna fisheries? (*b*) How are these fish caught? (*c*) How are they prepared?

2. (*a*) Work up a report for class on the salmon industry; include the salmon and its habits, the factors which make the Pacific coast the great fishery, catching the fish and preparing them. Contrast the methods of catching cod, salmon, sardines, and tuna.

3. (*a*) What handicaps do tropical regions have for the development of a large fishing industry? (*b*) How do tropical fisheries differ from banks fisheries?

4. (*a*) Where are the principal fresh-water fisheries of North America? (*b*) Of Europe? (*c*) Of Asia? (*d*) By what methods are the fish caught? (*e*) Why does China have fish farming?

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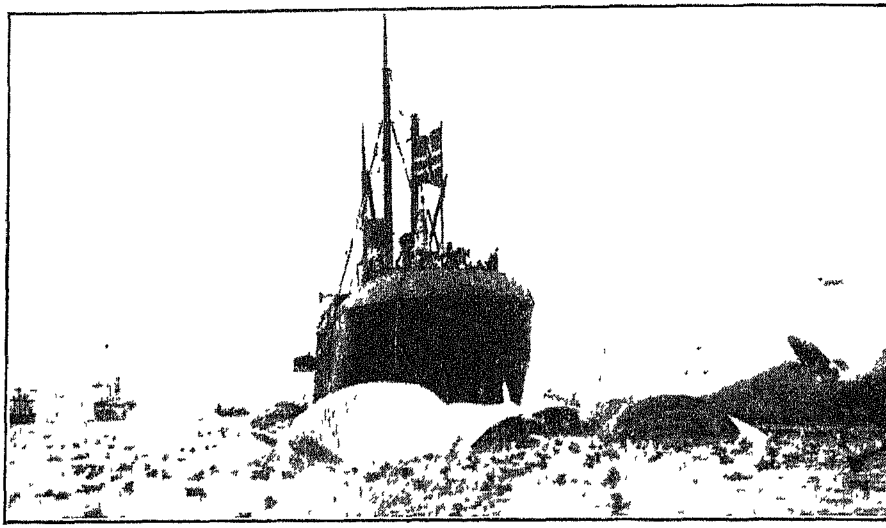


*Courtesy of Eneret Wilse*

FLOATING WHALE STATION AT SPITZBERGEN

FIG 32 On the map pages 30–31, locate the chief whaling grounds How many whales can you count in the picture?

## CHAPTER VII

# MISCELLANEOUS FISHERIES

**Whaling.** In the city of New Bedford, Massachusetts, is one of the most interesting museums in the United States. Connected with it is an old whaling vessel located on the estate of a family which became wealthy from whaling. Today we regard the boat as a relic of a once great New England industry, for in 1850 — the peak year — the harbor of New Bedford was the starting point for almost four hundred such craft. Other important whaling places were Nantucket and New London, Connecticut. Whaling gave New England one of the most profitable and exciting occupations of the nineteenth century. In the twentieth century whaling still has plenty of excitement and is profitable on a reduced scale, but not in New England. The story of the decline of whaling furnishes the economic geographer a valuable illustration of the effects of the ruthless exploitation of a natural resource and the discovery of new resources.

The whale, which is not a fish but a warm-blooded mammal, is a great rover The largest of all animals, the whale can live anywhere in the ocean but it prefers cold waters. As a result, the early whalers traveled the high seas for many months on a single voyage, pursuing whales in every part of the open waters of the arctic and antarctic regions. The long absence from home ports was only one phase of what was probably the hardest work of all sea occupations. But the capture of a whale, weighing as much

as fifty to seventy tons, meant large profits. Many men also went whaling for the adventure. Often they had more than they expected. Their work took place largely in cold waters, beset by storms, and a flip of a whale's tail could destroy the small boat from which the harpoon was thrown. After subduing the whale, the men had more laborious tasks. Imagine the work of cutting up one of these monsters in a heaving sea of icy waters! Then came the rendering of blubber into whale oil, the principal product, used in early days for lamps. At one time the oil was worth more than a dollar a gallon and a single boat sometimes returned with more than $100,000 worth. Obtaining whalebone and ambergris added to the work. So many whales were taken that ships had to make longer and longer voyages to find new grounds and the whale seemed on the road to extinction.

During the Civil War the New England whaling industry received a serious setback as many ships were involved in the hostilities and sailors joined the northern navy. A few years later, kerosene made whale oil as a fuel practically obsolete in the United States. Today this country has very few whaling vessels and these sail chiefly from San Francisco to the northern Pacific. Norway now leads the world in whaling.

The Norwegian whaling industry is an up-to-date business, with incorporated enterprises as in a real manufacturing industry. Many of the ships are huge, of many thousand tons, and are floating factories equipped with many labor-saving devices (Fig. 32). Powerful harpoon cannons are used; one ship in a cruise of eight months caught three hundred whales. Antarctic waters now furnish the great whaling grounds, especially near the South Shetlands, South Orkneys, and South Georgia.

Every ounce of the whale today has some use. The meat and bones, which formerly were thrown away, are ground and made into fertilizer. Sometimes stock feed is made from the flesh. Whale oil, sperm oil, spermaceti, ambergris, and whalebone have found new uses. In addition, the whale has good meat which people eat in lands having limited meat resources, like Japan, China, and Norway. The tail when pickled is considered a delicacy by Orientals. American whalers on the Pacific prepare large numbers for the Far Eastern market.

**Sealing.** Whales were saved from rapid extermination largely by the discovery of petroleum. Fur seals would probably have become a rarity, except for strict international laws. The beautiful fur seal gave great profits and caused men to hunt them ruthlessly.

Years ago the fur seal lived in many parts of the ocean, chiefly in cold waters. Today a genuine seal coat represents a large sum of money because few seals of this type remain. In South America, for example, seals abounded in the cool waters of the western coastal current and had breeding grounds from near the Equator to Cape Horn. At present, the principal seal herd of South America lives near Lobos Island near the mouth of the La Plata River, where Uruguay maintains strict control of hunting.

In the Northern Hemisphere, where the leading sealing grounds lie, the fur seals gather chiefly in the Pribilof

*Courtesy of United States Bureau of Fisheries*

FIG 33 SEALS ON PRIBILOF ISLANDS

Islands owned by the United States To these islands of the Bering Sea the seals used to come by the million. After the United States purchased Alaska, the government granted to several companies the right to hunt the seals. These companies so rapidly and thoughtlessly slaughtered the animals that by 1910 the government had to manage the industry in order to prevent the extermination of the seals A year later, an international agreement by the United States, Russia, Japan, and Great Britain stopped all open water or pelagic sealing Now only the three-year-old males are killed while on the islands where the seals gather to breed in late summer. As a result the herds on the Pribilof Islands have multiplied sixfold since 1910 Here the cold waters, many fish, and lonely lands of few people favor them Other seal grounds belong to Russia in the Commander Islands and to Japan in Robben Island.

As with the whale, every part of the seal now has a use. The skins from the Pribilof Islands eventually go to St. Louis, the center of the American raw-fur industry (Fig 33) The Aleut Indians, who inhabit parts of the Pribilof Islands, eat some of the meat, some is fed to the blue foxes raised on these islands by man, and the residue makes oil and fertilizer

The hair seal has suffered a fate similar to that of the fur seal. Because of the wholesale killing of the seals a formerly very profitable industry has been reduced to one that often does not pay the expenses of a voyage What remains of this industry belongs chiefly to the coasts of Newfoundland, Labrador, and Greenland. Oil and leather are the principal products.

**Shell Fish and Crustaceans.** The abundance of food from the sea has no better illustration than the large numbers of oysters, clams, scallops, lobsters, crabs, and shrimp easily available for man's use. Shell fish (oysters, clams, scallops) in particular give mankind some of its most easily

procured foods, in some cases, not even requiring the fisherman to go to sea to procure it. When boats are used they travel only a short distance from shore, as all of these forms live in shallow water

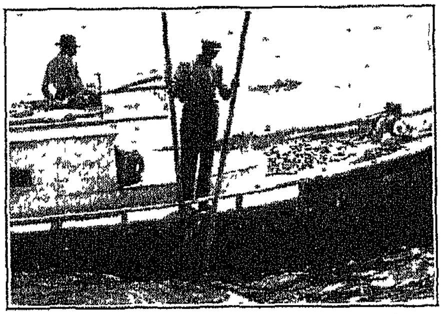
It is not surprising therefore that the oyster, the most valuable of the shell fish, has been used throughout historic times The ancient Greeks and Romans were very fond of oysters and today coastal peoples in many parts of every continent eat them In the United States, the oyster fisheries have gained their greatest value, this country using more than three times as many oysters as all Europe. Our appetite for this delicious sea food has made the oyster industry the foremost single fishery of the Atlantic coast It is also important in California. For the country as a whole, within the fishing industry, only the salmon has a greater value in yearly output. France leads in the oyster industry in Europe because of extensive beds in the warm waters of the Bay of Biscay.

The Atlantic coast of the United States from Massachusetts to Mexico gives the oyster a good home. Long Island Sound, the protected bays of the southern coast of Long Island, Delaware Bay, and Chesapeake Bay are the outstanding oyster grounds Here the mollusk has large areas of sandy or gravelly bottom, quiet clear water, an abundance of the microscopic plants comprising the food of the oyster, and objects to which the young oyster may attach itself when it starts making its permanent home

In order to gather oysters dredges and large tongs operated by hand are employed (Fig. 34). As the oyster is very perishable, most of the catch is consumed near the fishing grounds. Philadelphia eats more oysters than any other city in the world, while Baltimore and New York run close to it. In such centers, quantities are served raw "on the half-shell." For more distant markets, only the flesh of the oyster is shipped, for the heavy shell would add greatly to the cost of transportation In addition, canneries put up large amounts for shipment to many parts of the United States and abroad

The shells have three uses Poultry eat them when broken into small bits, the shells furnishing calcium carbonate which aids in the formation of egg shells Some are made into a lime for plaster and fertilizer Most valuable is the use in raising oysters under human care.

Besides eating so many oysters, man has destroyed much of a valuable industry by polluting coastal waters. In the United States, even today when much has been done to increase the production of oysters, we produce only two-thirds as much as in 1900 Had man no way of "cultivat-



*Courtesy of Middle Atlantic Fisheries Association*

TONGING OYSTERS, LONG ISLAND

FIG. 34 In this region most of the oysters are gathered by dredges and not by hand, but tonging is the chief method in Chesapeake Bay.

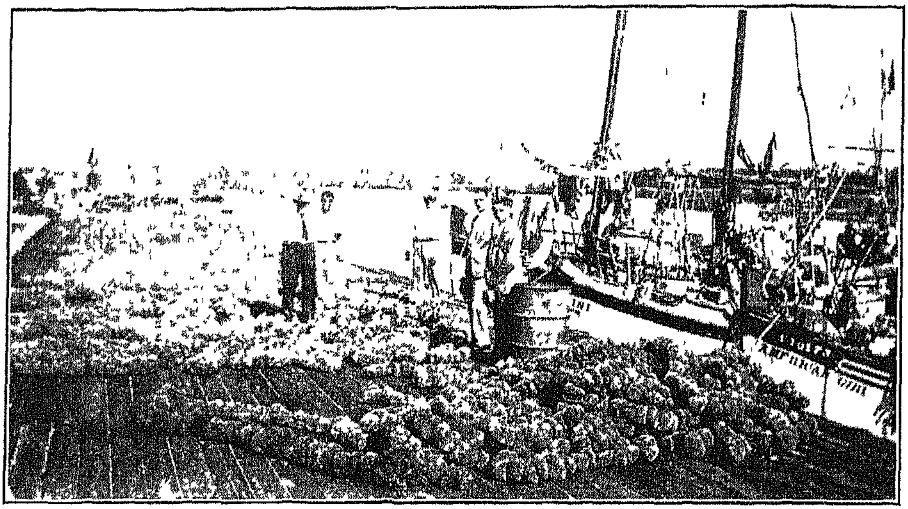


FIG 35. SPONGES ON THE WHARF AT TARPON SPRINGS, FLORIDA

ing" oysters, he would probably have lost a prime food many years ago

For hundreds of years the Chinese and Japanese have raised oysters The tide of ten to fifteen feet in Japanese waters, exposes twice daily a large area of bottom suitable for oyster growing. As the United States saw the natural yield of oysters shrink, this country began to raise oysters with success The oysters help very much. A mature female oyster lays as many as sixty million eggs a season and the young oysters do not wander far from their birthplace The oyster "farmers" select a good location and generally scatter oyster shells on the bottom. The shells serve as holdfasts for the young shell fish. In colder waters, the oysters mature in four or five years, in warmer waters in two years.

**Sponges.** Like the oyster, the sponge has been important throughout historic times. The ancient Greeks had a large industry in the Aegean Sea. To this day this is a leading sponge area, although an American center has recently become the world's largest market. The warm, shallow, clear, coastal waters of the Gulf Stream and the Gulf of Mexico provide conditions suitable to the growth of the sponge, which really is a mass of the skeletons of tiny animals On this side of the Atlantic the industry has had an interesting migration from the Bahamas to Key West and Cuba, and now the picturesque town of Tarpon Springs, Florida, leads in sponge culture (Fig. 35).

Tarpon Springs is practically a foreign settlement in the United States, for the sponge has attracted a colony of Greeks who gained their experience in the Mediterranean These people give all their efforts to sponge fishing. Sponges are gathered from the bottom of the shallow seas by men with long tongs or by divers who descend and loosen them with their hands.

**Pearls.** The beautiful gem, which for its size is the sea's most valuable product, for centuries has attracted man in many parts of the world. It

comes principally from an inedible oyster which lives in warm clear waters and prefers coral reefs or limestone bottoms; the best pearl grounds are those of the Persian Gulf, Ceylon, Venezuela, Panama, Mexico, and Malaya. Diving for pearls rarely is the only object of the divers, as the pearls are too scarce. The power of the oyster to produce the pearl appears also in the lining of its shell, known to us as mother-of-pearl. In the majority of pearl grounds, mother-of-pearl, which makes fine buttons, knife handles, and similar articles, gives the people most of their income. The United States, which has no pearl oysters, obtains thousands of tons of a pearly material for buttons from the shell of mussels found in great abundance in the upper Mississippi system. These mussels sometimes contain pearls. "Cultured" pearls are developed by the Japanese, who have been able to raise the pearl oysters and by a delicate operation cause the oyster to develop pearls about a tiny obstruction inserted beneath its epidermal tissue.

## THE CONSERVATION OF FISHERIES

As we have seen, the waters of the earth are one of man's most valuable sources of food. Besides they yield quantities of other materials, from chicken feed to jewels. So far man has given little in return. When a farmer wants a good crop, he carefully prepares the soil, uses good fertilizers, chooses good seed, and tends the growing plant. But the fisherman in most cases merely takes what the waters produce. Fishing is still largely an extractive industry and often is termed a "robber" industry.

Nevertheless, we can find evidences of man's changing attitude. Although the sea still contains enormous quantities of food, the old fishing grounds are yielding fewer fish. Fishermen have to go farther and farther to make good hauls. As a result, more attention is being paid to the conservation of fisheries. In the United States, even though we have many other food supplies, conservation of fisheries has become very important. We have noticed the fact of man's aid in safeguarding especially the salmon, seal, and oyster. In addition, the government maintains many fish hatcheries to stock the inland waters of the country and has many experts studying all the important fisheries. In countries with fewer resources, fish culture has reached greater development, as in China, Japan, Germany, and other lands where fish are grown in ponds.

At the same time that man has tended to replace what he has taken, he has considered the problem of pollution. Many harbors on the sea and many inland waterways, which formerly were rich in fish, today have practically none because of man's carelessness in disposing of the sewage from great cities and refuse from factories and ships. For some fisheries this has little significance, but for those based on fish which feed near shore, it is a serious problem.

## EXERCISES

1. (*a*) Why was whaling so important in the nineteenth century? (*b*) What caused the decline of the New England whaling industry? (*c*) In how many ways was this industry valuable to New England? (*d*) Where is whaling im-

portant today? (*e*) How does the industry of today differ from that of seventy-five years ago? Look up in an encyclopedia the use of whale oil, sperm oil, spermaceti, ambergris, and whalebone

2 Outline a twenty-minute talk on sealing (*a*) Why are seals so valuable? (*b*) Where are important sealing grounds today? (*c*) What factors explain their location?

3. (*a*) What factors explain the great oyster fisheries along the east coast of the United States? (*b*) Where are most of the oysters canned?

4 (*a*) The best lobster fishing region of the world is along the Atlantic coast from New York City to Newfoundland. Why? Canada catches more lobsters than all the rest of the world and exports quantities in cans. (*b*) How are lobsters caught? (*c*) How are they shipped to consuming centers?

5 (*a*) What conditions are necessary for great sponge fisheries? (*b*) Where are the chief sponge fisheries?

6 What conditions explain the location of the great pearl fisheries?

7 Why is fishing often termed a "robber" industry?

8 Plan an extra lesson on "Fish culture and conservation"

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"Lobsters" — **C**, XLIV (1923), 567 ff., especially 573, 575, 579–584, and 633, **9**, pp. 178–182
"Fish Culture and Fish Conservation" — **C**, XXIII (1912), 502–514, XXIX, (1916), 546–583, XVI (1905), 214–217, XXII (1911), 1139–1165; **24**, pp. 351–353, **71**, pp. 95–96.
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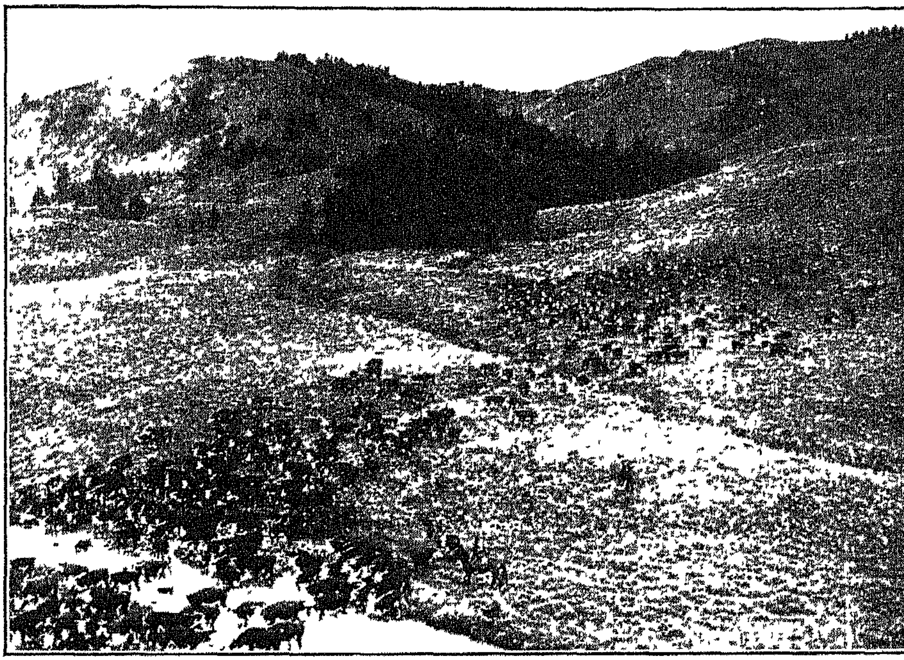
[1] Numbers and letters refer to Selected References on pages 420–424.



*Courtesy of Charles J Belden*

HEREFORD COWS WITH CALVES, PITCHFORK, WYOMING

FIG 36 Extensive grasslands and fresh water favor grazing in the Great Plains and Rocky Mountains These cows raise calves that are shipped, after they are one year old, to the corn belt for fattening Most of these lands, too dry for crops, produce a valuable food supply by using the grasses.

CHAPTER VIII

# GEOGRAPHIC BASES OF THE GRAZING INDUSTRIES

**Man's Dependence on Animals.** Have you ever thought of what kind of world we should have if all animals disappeared overnight? We should have a hard time living without animals. Could we easily do without meat, eggs, milk, butter, cheese, leather, and wool? Also, power is one of the greatest gifts of animals to man. Animals to pull plows and carry loads are of tremendous value Even the strength of machines is measured in horsepower

Animals obtain food for us from millions of square miles of the earth's surface which are too dry, too wet, or too cold for crops Most of the earth having such physical characteristics belongs to desert, savanna, temperate grasslands, or tundra All of these have some grazing, but in the temperate grasslands, such as the steppes in Eurasia, the pampa in South America, and the prairies in central North America, animals give us their greatest service in changing grasses to edible products If we had no such means of using the grass-

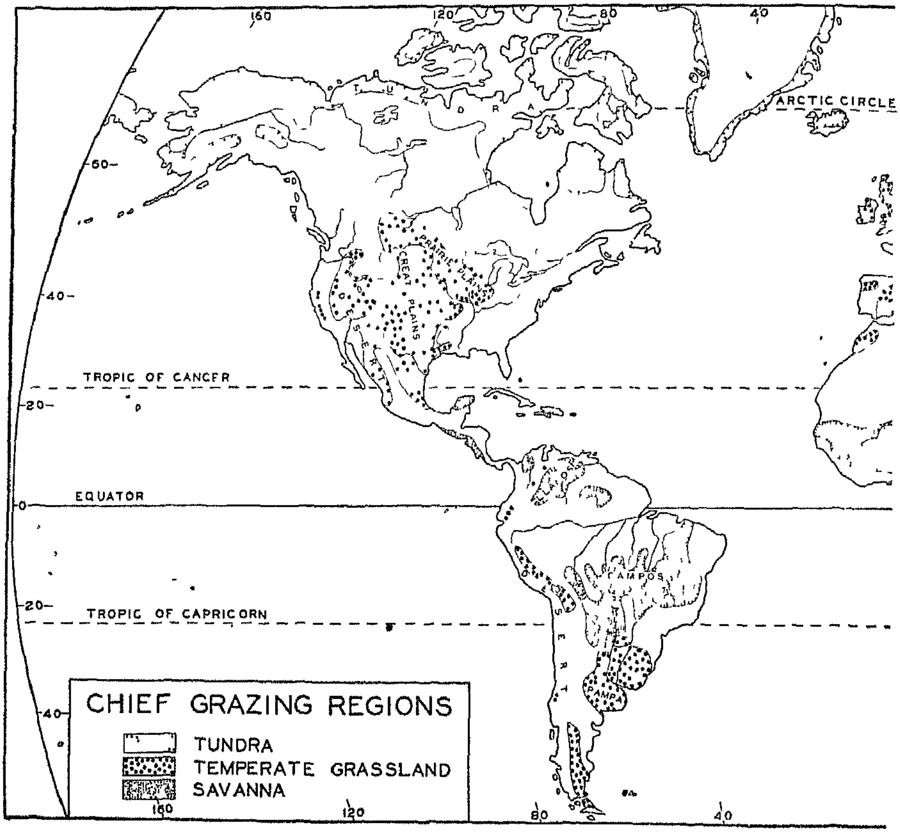
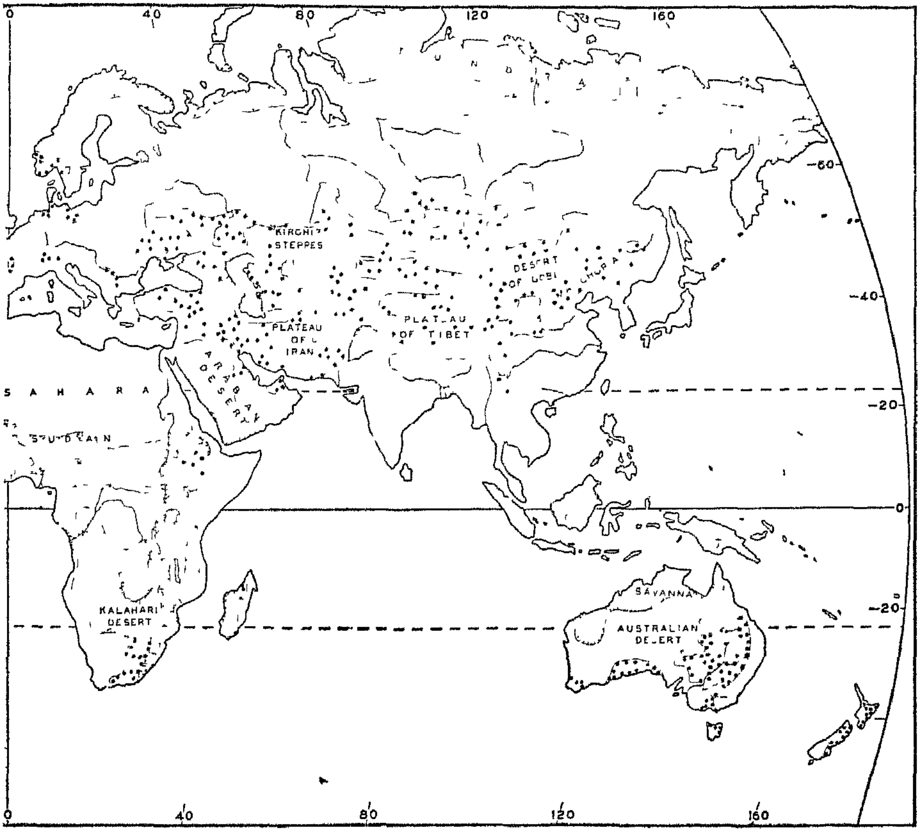



FIG 37 One of the types of grazing areas produces almost no crops Point out four What is the density of population in the tundra? In the llanos? The Sudan? The

lands, some of the most productive lands in the world would lie idle today (Fig 36).

**Climate and Grazing.** What three vegetation regions are used for grazing (Fig. 37)? Compare the tundra, the annual rainfall map, and temperature map. What factors cause the tundra? In general how much rainfall do the temperate grasslands receive? The tropical savannas?

Although some of the temperate grasslands, as the prairies, have as much as thirty inches of rain per year, in all the large grazing lands of the world much depends upon the amount and seasonal distribution of the water supply Even thirty inches of rain is insufficient if the seasonal distribution is too uneven. In the llanos of Venezuela there are places which receive almost fifty inches a year; yet in the period from December through February less than one-tenth of one inch falls Such uneven distribution of rainfall accounts in large part for the growth of grasses instead of trees in the temperate grasslands and tropical savannas (Figs. 38, 39, 40, and 41). When the Great Plains have winter in December to February inclusive, what is the rainfall in the pampa? In June to August what is the rainfall of the two areas?




*After Schimper, Shreve, Shantz, Taylor, Jones, Philip and Goode*

temperate grasslands that lie in high mountains or plateaus Name five large savannas Kirghiz steppes? Southern South America?

What is the rainfall June to August in the campos,[1] the savannas of southern Africa and northern Australia? What are the conditions in these same areas in the other three seasons of the year? Study especially the seasonal rainfall in the sudan, the llanos, and Bolívar savannas What is the chief cause of tropical savannas?

Point out the relation of seasonal rainfall to the pampa, steppes of South Africa, and the temperate grasslands of Australia Do the same for the temperate grasslands of North America, Europe, and Asia As we proceed with our study, we shall find that seasonal rainfall distribution affects man's activities in many vital ways.

The dry season has kept the population of grasslands relatively sparse and has retarded the spread of farming. The terrible droughts that grip these lands do enormous damage to plant, beast, and man. In Uruguay the drought of 1914 killed six hundred thousand cattle and five million sheep. Since 1880 Australia has had fourteen

[1] *Campos* is the name given to the savannas of Brazil, *llanos* to the savannas of the Orinoco lowland, *sudan* to the savannas of north central Africa, and *chaco* to the savannas of western Paraguay, eastern Bolivia and northern Argentina.

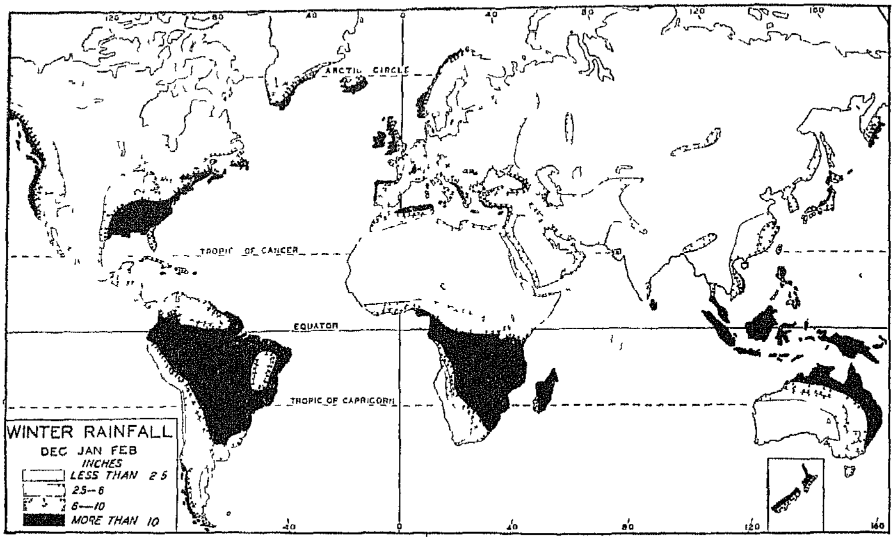



FIG 38 When the Northern Hemisphere has winter, the Southern Hemisphere has summer, when the Northern Hemisphere has autumn, what does the Southern Hemisphere have? When does southeastern Asia get most of its rain? When do the Great Plains of the United States get most of their rain?

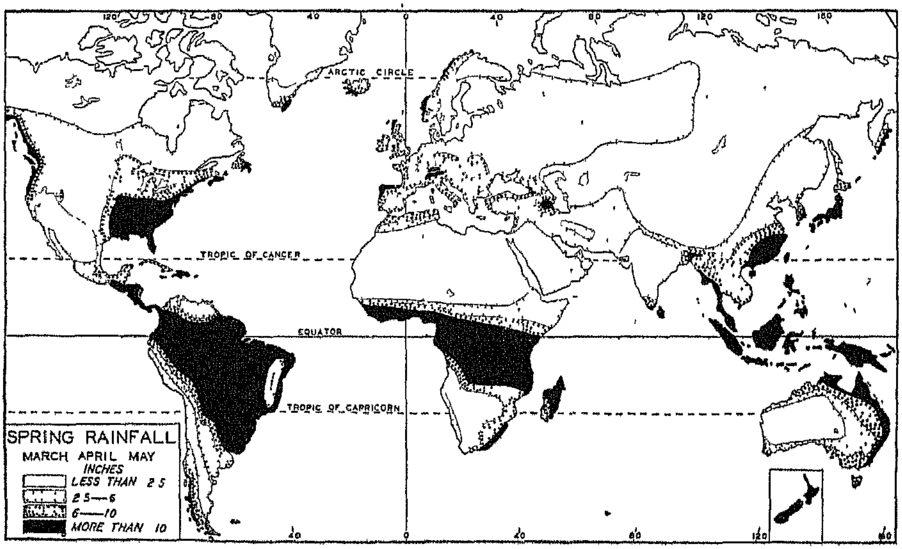



FIG. 39. How many regions north of the Arctic Circle have heavy rainfall (see also page 84)? What type of vegetation do the regions of light rainfall of the far north have (pages 60–61)? These regions are always cold (pages 14–15).

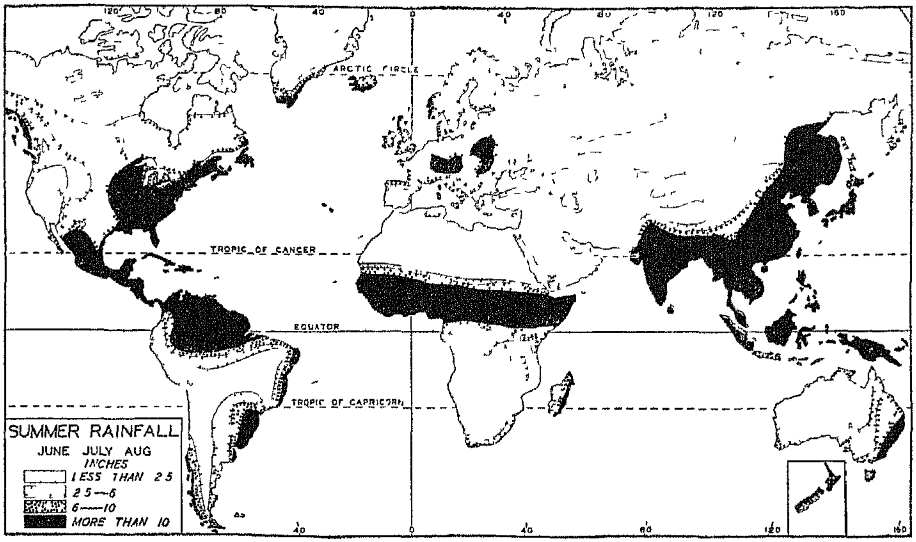



FIG 40 List six temperate regions that have less than ten inches annual rainfall Are these all dry in all seasons? List six or more hot regions that have more than eighty inches annual rainfall Do these regions have a dry season? What type of vegetation do they have?

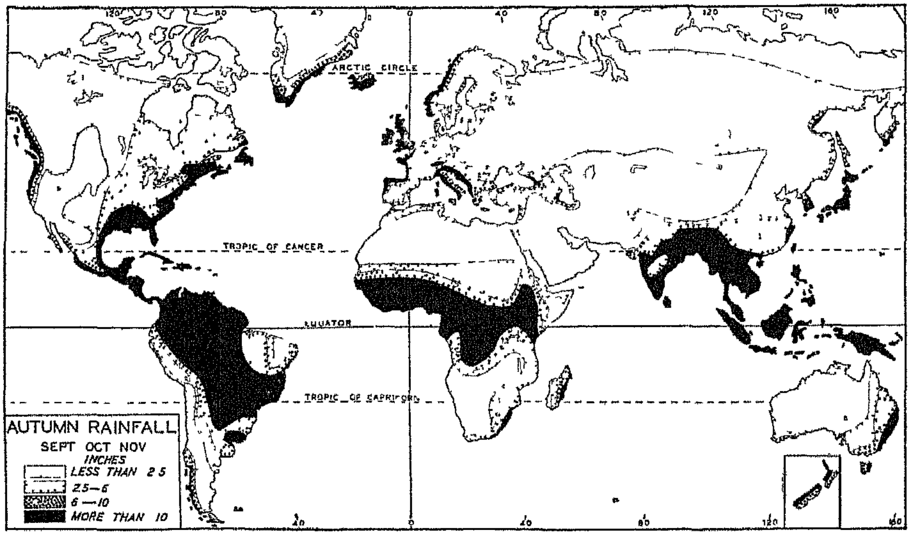
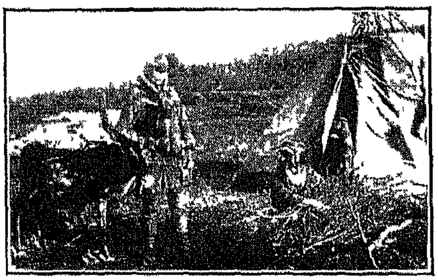



FIG 41 What two large areas in South America are rainy for three seasons, but have less than two and one-half inches for three months (page 62)? In Africa? One in Australia? Note the seasonal rainfall in southeastern Asia

disastrous drought periods. In the worst of these, which ended in 1902, forty million sheep perished; in the drought ending in 1914, twenty-four million died. In such regions, why are animals more dependable than crops?

Cold grazing lands are of two types — cold mountains and plateaus, and the tundra. The inhabitants depend on animals even more than is the case in the temperate grasslands and tropical savannas. There are few or no crops. In mountain areas, too cold and rough for crops, grazing gives man the major part of his livelihood; generally, low valleys furnish some of the necessities. This kind of grazing has its most extensive illustrations in the Andes and in the plateau of Tibet. Many districts in the Rocky Mountains also depend on such grazing. In Switzerland mountain grazing is developed to the most productive degree in the world.

Crops have no part in the work of the people of the tundra; there the only domestic animal capable of supporting man is the reindeer. With their broad sharp hoofs, these animals can dig through the winter snow to find forage. Only a few people depend on them: the Lapps of northern Scandinavia and Russia, the peoples of northern Alaska, and the peoples of northern Siberia, whose reindeer furnish most of the requirements of food, clothing, shelter, and transportation (Fig. 42).



*Courtesy of Eneret Wilse*

LAPPS IN NORTHERN EUROPE

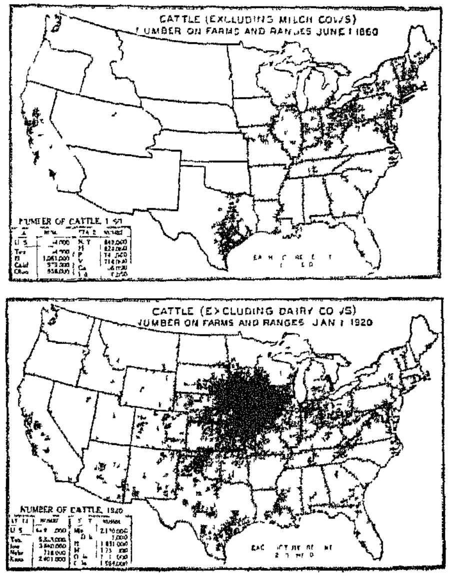
FIG. 42. This picture was taken in summer. How is the reindeer adapted to life in the tundra? Why is the reindeer so valuable to the Lapps?

**Grazing and Population.** Of the three types of grazing lands, which two have very few people (pp. 4–5)? The geographic conditions underlying grazing impose strict limitations on population and its distribution. The sparse population in such regions does not often congregate in large settlements. Animals, feeding solely on what they find in the open, require much grazing ground in order to obtain a meal.

Among primitive peoples living in the less desirable grasslands, we find nomadism common. The only town life that such groups know comes when they go to the trading centers where the grassland and a region of crops meet. Among the more advanced grazing regions, we find traces of nomadism in the size of the properties, as in the American ranches or the Argentine *estancias*. But a fence around the property means that the animals do not rely wholly on natural forage. It means also that the population is growing and the animal products bring enough money to pay for fences, feed, homes, and windmills.

If a grazing area is productive enough to be fenced, in time it may lose much of its grazing character and become crop land. The fence indicates that population is increasing and since the food value of crops is greater than that of animals, the better land is cultivated to support the larger group. The more the population in-

creases the more land is taken out of grazing and given over to crops A growing population pushes grazing to the outermost frontiers Many animals remain within the crop region, as they utilize the poorer fields, eat the parts of crops not eaten by man, furnish transportation and power, and provide a variety of food and raw materials Nevertheless, the farms devoted almost entirely to grazing are located far from the centers of population Even in the pampa, which contains some of the world's finest natural grazing areas, every full-grown steer needs from four to seven acres of good grass Wide range for animals is available only where land is cheap and population small




*Courtesy of United States Department of Agriculture*

DISTRIBUTION OF CATTLE IN THE UNITED STATES IN 1860 AND 1920

FIG 43 The greatest cattle state in 1860 was Texas Where were the cattle marketed? List all the conditions you can to explain the great westward migration of the cattle industry in the United States between 1860 and 1920

In the United States, we have excellent illustrations of the way population encroaches upon grazing areas. In 1900 Texas had 3,000,000 people and 6,419,000 cattle. But in 1928 it had 5,447,000 people, and only 5,600,000 cattle New York in 1840 had 5,100,000 sheep, but today our most populous state has less than 500,000. The same point is shown by the number of animals per person In 1840 the United States had about one head of cattle for every person, in 1930 there was only one-half as much for each person. Study the westward movement of cattle in the United States on the maps 1860 and 1920 (Fig 43).

We have seen that increasing population limits the number of animals. If the world's population continues to increase for a long time, what will happen to the grazing industries? Much has already happened. The people in the most populous countries either do not eat much meat or they buy their supplies from the outlying grazing regions of the Southern Hemisphere. As more land must grow crops, animals are pushed into more remote and less desirable districts and they become less numerous. The per capita consumption of beef in the United States declined from eighty pounds in 1900 to forty pounds in 1933. If people continue to eat much meat, prices will rise In addition, more intensive use of grazing lands will be made Cattlemen will spend more money on improving the animals and the land Besides, as meat becomes too expensive, people eat more of other foods. This has become very noticeable in the United States, as we eat much more dairy products, vegetables, and fruits than thirty years ago.

## EXERCISES

1 (*a*) List the ways in which man depends on animals (*b*) Which do you consider the two most important uses?

2. Answer all the questions and complete lists (*a*) in the section on "Climate and Grazing" and (*b*) under the maps, "Grazing Lands" and "Seasonal Rainfall" (*c*) What two types of cold grazing lands are there? (*d*) Why is the reindeer so valuable to the Lapps?

3 (*a*) What factors tend to make the great grazing lands regions of sparse population? (*b*) Why do these lands tend to become more settled? (*c*) In what position do you find the chief trading centers of these grazing lands? (*d*) When the margins of the grazing lands become more settled, what three things happen to the animals? (*e*) What relation exists between the increase of population in a country and (1) the numbers of animals, and (2) the amount of meat eaten and its price?

4 Write the list of conditions called for under Fig 43.

## AN EXTRA LESSON

Make a study of

(1) "Reindeer Grazing in Northern Eurasia" — **J**, XIII (1923), 223–242, **27**, pp 386–390; **L**, I (April, 1931), 7–12.

(2) "The Development of Reindeer in Alaska" — **C**, XXXVI (1919), 539–556, **A**, IX (1933), 292–302, **71**, pp 275–292, **87**, pp 646, 653–657.

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"The Cattle of the World and Their Place in the Human Scheme of Things" — **C**, XLVIII (1925), 591–710 (many photographs); **P**, LXI (October, 1933), 38 ff

"Our Dependence upon Beasts of Burden" — **24**, pp 199–215

"Relation of Cattle to Climate" — **A**, III (1927), 466–485

"The Distribution of Domestic Animals" — **A**, I (1925), 143–172

"Dogs in Harness" — **L**, I (February, 1931), 1–7.

[2] Numbers and letters refer to Selected References on pages 420–424

## CHAPTER IX

# GRAZING IN TEMPERATE GRASSLANDS

Each continent contains a large expanse of temperate grassland, often called steppe. The steppe is almost pure grassland, thousands of square miles have no trees, although in places moist valleys may have a few trees. The rainfall of these grasslands ranges between ten and thirty inches per year, the drier margins merge with deserts, the wetter margins with forests or savannas. When do the rains fall in the temperate grasslands (pp 62–63)? The growing season is short. High winds sweep over the land. On the whole, the climate may be called severe It explains why grasses instead of trees grow in steppes. Do these lands have many people?

## § I — THE TEMPERATE GRASSLANDS OF THE NORTHERN HEMISPHERE

A great expanse of grassland lies in Asia. In these steppe lands we find an interesting example of a people depending almost entirely on grazing

### THE KIRGHIZ OF THE ASIATIC STEPPES

**An Ungenerous Land.** The Kirghiz have the least productive of the world's great grasslands. Most of their homeland has less than ten inches of rainfall per year; in some years so little rain falls that large parts of the region become desert. Life is hard and the character of the people shows it. The problem of food bothers them all the time. The land is so poor that little food can be stored. Hence the Kirghiz and similar peoples of Central Asia have to become nomads to live in such a region Some of them live in the better-watered districts about the southeastern borders of the steppe, but the majority have as a home the hundreds of thousands of square miles of mountains, plateaus, and lowlands between the desert of Gobi and the Caspian Sea. Other similar lands include the steppes in Manchuria and the plateau of Iran Fortunately in these areas the rainfall comes chiefly in the summer when it does grass most good. But in the summer the mountain pastures are also green and as they are better, the people spend that season in the bordering plateaus and mountains (Fig 44) As the cold and snow of winter close these pastures, the people move to the dry lowlands where the grass produced by summer rains has kept in good condition and where light snows may provide water for the stock. Since the grass is scattered and water not abundant, the groups of Kirghiz and other tribes seldom form large camps or stay long at one encampment. To live through the winter, many must move to small irrigated strips When their numbers

*Courtesy of Sovfoto*

KIRGHIZ CARAVAN

FIG 44 These people, with their animals, tents, and household utensils, are moving into high summer pastures List the factors that cause this land to have little value

become too great and their pastures give out, the nomads do not hesitate to capture supplies from traders or farming peoples.

**Animals the Staff of Life.** Their animals are mainly sheep and cattle, but they keep horses on which to ride, camels to carry their scant belongings, and goats for milk and meat From the animals, the Kirghiz get nearly everything they use Sour milk, cheese, and a little meat are staple foods Any other food is a delicacy and is obtained mainly by selling animals in trading centers about the borders of the steppe. In this way they are also able to get some of the cloth needed for garments, but most of their costume comes from the fiber and skin of their animals. Their dwellings consist of easily constructed tents formed by slender willow poles, obtained in the river valleys, and covered by felt made from wool.

Do you wonder that these people have made practically no progress in thousands of years? Centuries before Christ they lived in much the same manner as today Their environment has made life too hard for the Kirghiz to develop much of a civilization The large grazing regions of the world in general show some backwardness due to the difficulty of obtaining enough food, but the Asiatic steppes, because they are so dry, mountainous, and isolated, are the least productive of the extensive grasslands

## NORTH AMERICAN GRASSLANDS

The grasslands of North America, which lie chiefly in the United States and the prairie plains of Canada, are today a rich grazing and farming area (Fig 45). Yet when white man discovered the fertile prairies and the Great Plains, he found people with a low order of civilization Although the Indians of the grasslands raised a

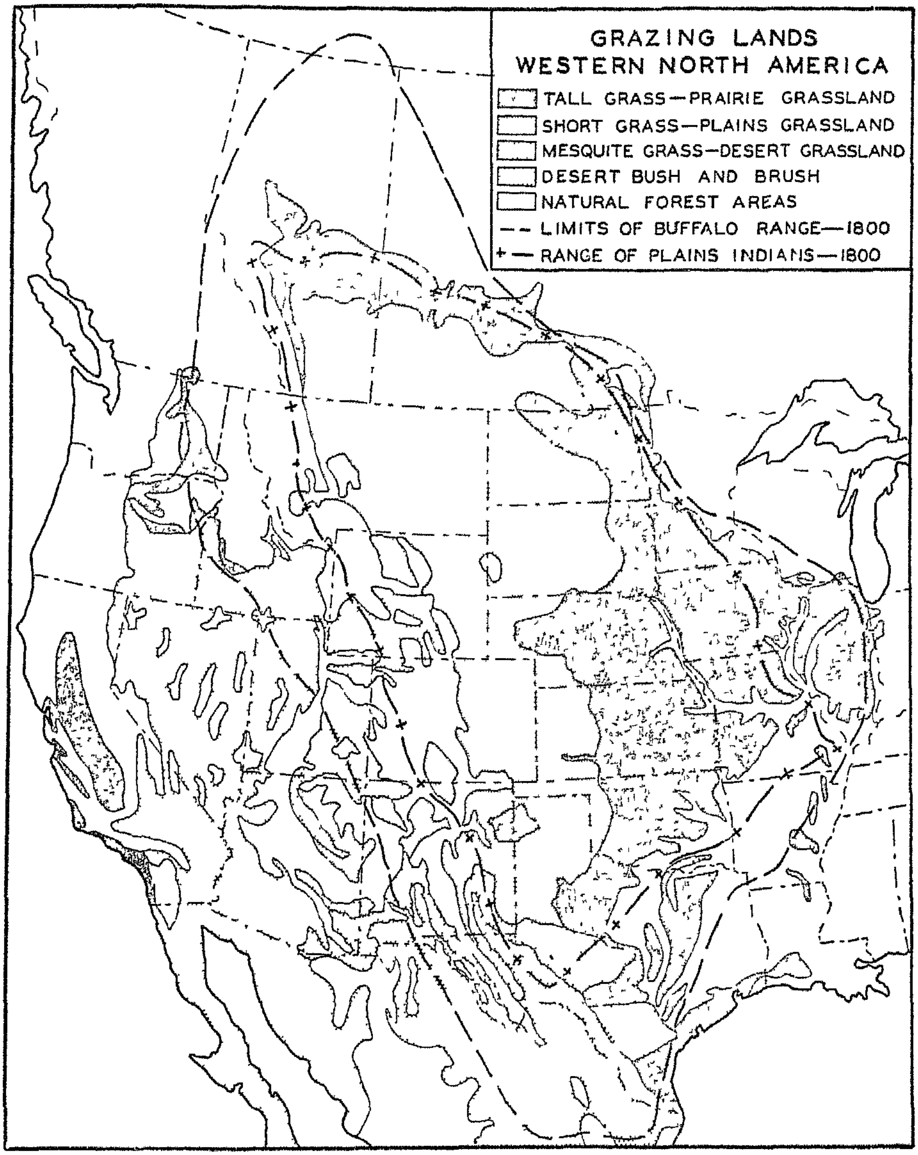



FIG 45 Note the different types of grassland in western North America When Union Pacific trains first began to run, herds of buffalo moving north or south stopped the trains for hours What is the chief use now of the land in the prairie grassland region? Where do you find most of the sheep (page 96)?

few crops, they had to hunt or fish for most of their food.

**The Value of Domesticated Animals.** The white men began making the grasslands into valuable agricultural regions by introducing grazing. Before they came, enormous herds of buffalo furnished food and raw materials for the Indians, but these were wild animals; the nomadic Indians

Courtesy of Charles J Belden

BRANDING CALVES

FIG 46 In the days before fences, all cattle had to be rounded up and branded Even today the calves are branded before they are taken from their mothers and turned onto open range in the mountains

had to hunt them The Indians had no grazing industry because they had no domesticated food animals This lack greatly handicapped them. If they had had animals to pull plows and carry large loads, as well as to provide nourishment, they might have developed a wonderful civilization. Whatever land the Indians used for crops they had to prepare by hand labor The grasses formed so tough a sod that this was heavy work.

After being introduced by the Spaniards, cattle and horses soon ran wild on the plains. The grasses, favoring buffalo, favored them also They were hunted as were the buffalo, and the Indians soon tamed horses for riding. The Spanish longhorn cattle were well suited to life on the plains.

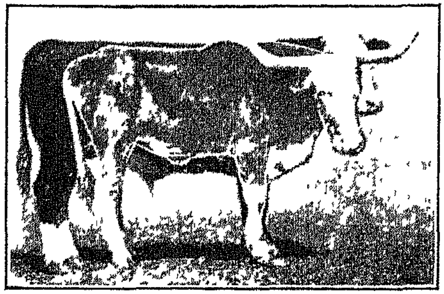
## THE UNITED STATES' CATTLE GRAZING INDUSTRY

The vast semiarid lands of the west give us one of the most romantic of all industries. What American boy or girl does not know of the "open range," "Texas longhorns," "cowboys," "rustlers"? Every year many books and magazine articles entertain millions of readers with tales having the western grazing lands for a setting, while moving pictures and the radio thrill millions with western stories.

The industry is interesting and romantic because of its numerous hardships Although the cowboy has never suffered so much as the Kirghiz in a dry year, he has had many troubles in establishing grazing (Fig 46). Many of the problems have been

solved but the pioneers had to contend with obstacles ranging from aridity to hostile Indians The climate favored grasses and grazing but it was variable Water supplies fluctuated greatly, strong winds made early travel difficult, winter blizzards sometimes killed thousands of cattle, wolves, coyotes, and bears constantly endangered the stock, Indians, wild cattle, and horses stampeded large herds and caused them to escape, the south had the Texas fever tick, and when a cattleman began to fence his pastures other cowboys would cut the wire fences to let their cattle pass On the other hand there were huge plains of grassland, capable of supporting herds throughout the year; there was range enough for millions of animals. Also in the mountains were luxuriant summer pastures. In the early years the animals received very little attention, but proved profitable, for to the east was a large market.

**Open Range and the Longhorn.** The policy of the government helped make the early industry more romantic. It forbade large properties in much of the west. Since small properties could not support a family, few people settled these lands early Therefore the cattle were let loose on the plains and from time to time the picturesque round-ups took place to brand the cattle. Most of the cattle came from Texas, where large properties had developed and where the mild climate permitted all-year grazing (p. 65). The cattle were a Spanish type, well suited to life on the plains. In its habits the Texas longhorn was like the buffalo. It was fleet of foot, hardy, and its long horns gave protection (Fig. 47).



*Courtesy of United States Department of Agriculture*

THE TEXAS LONGHORN STEER AND THE HEREFORD BEEF STEER

FIG 47 This picture strikingly shows the characteristics which adapted the longhorn steer of five hundred pounds for life on the open range, and those of the Hereford steer of one thousand pounds for producing beef

**Marketing Cattle in the United States.** Longhorn meat was not particularly good In the early days this did not matter much, for the cattlemen could not ship fresh meat to markets beyond the Mississippi River. Two non-perishable products, hides and tallow, made up a large part of the early commerce. Gradually the farmers nearer the consuming centers devoted more of their time to raising grains. For many years the settlers of the eastern prairies had stood in the way of the cattlemen on the Great Plains, for they also raised many cattle. As they lived nearer the cities their stock could be driven to market without great loss of weight, many herds were driven across the Appalachians Later the eastern cattlemen turned to crops for larger profits. In Illinois there developed the feeding of the cattle on corn raised in the prairies. Today millions of cattle are shipped from the grazing lands to the farms of the corn belt where they are fattened on corn (Fig. 48). To make

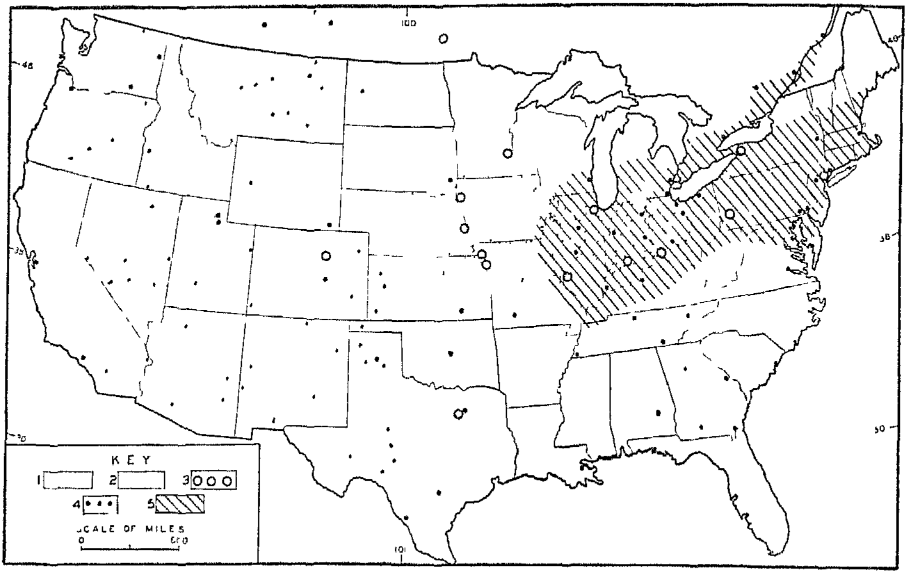



FIG 48 (1) The corn belt (2) Plains and mountain-grazing area (3) Chief market and packing centers (4) Secondary market and packing centers (5) Chief meat-consuming area The plains and mountain-grazing area has about one-third of the beef cattle of the country and the corn belt about one-third Why does the plains and mountain-grazing area have more than two-thirds of all the sheep (page 96)?

such a practice worthwhile, the grazing lands brought in pure-bred stock to replace the Texas longhorn The new animals are far better than the longhorn, being heavier, more compact, and having better meat But they graze on fenced ranges, are herded, and even fed alfalfa hay in the valleys. They could not live like the Texas longhorn and produce good meat.

Shipping cattle alive caused much loss to the industry Many of the animals died en route and all of them lost weight Besides every city had to have a large stockyard This wasteful system greatly handicapped the grazing industry But in 1875 came the refrigerator box car.

**Refrigerator Cars.** Refrigeration saved millions of dollars, cattle could be prepared for market in places nearer the grazing areas The refrigerator cars could carry the meat to all parts of the country and refrigerator ships to all parts of the world

**Alfalfa.** Since the improvement of breeds and the development of fenced ranches made grazing more costly, the industry added other improvements to utilize the fine pastures of the west While most of the grazing region receives little rainfall, the highlands with considerable precipitation make irrigation possible in many valleys. Irrigated areas throughout the grazing region produce feed for livestock. Practically every irrigated area grows alfalfa, one of the finest forage crops (p. 96). Alfalfa is used during winter or droughts where the natural forage is insufficient, and to fatten cattle for market.

**Competition between Sheep and Cattle.** In the Great Plains sheep came after cattle. This was due mainly to the Indians who closed

much of the Great Plains to the white man until railroads were built With the railroad available, cattle gave better returns because they required less attention than sheep A flock of sheep must have a shepherd to protect it, whereas a Texas longhorn steer could take care of himself. Since the cattle industry had first choice of the better grasslands, sheep grazing had to take the leavings, this delayed its development As the sheep tend to ruin the natural forage by close cropping, the two industries do not do well together Many bitter feuds have arisen between sheep herders and cattlemen The sheep grazing industry migrated even farther into the drier and less accessible districts

## EXERCISES

1 (*a*) Locate the temperate grasslands of the Northern Hemisphere. (*b*) What is the name given to the grasslands of central Canada? (*c*) The Great Plains (p 60)? (*d*) Asia east of the Caspian Sea? (*e*) Iowa? (*f*) What factors of the environment account for these grasslands?

2. (*a*) Point out on the map the home of the Kirghiz nomads (*b*) Why is the population sparse? (*c*) List seven or more conditions that make the people lead a nomadic life. (*d*) Why do the nomads make excellent soldiers? (*e*) Why have these peoples failed to develop great cities? (*f*) Great nations? (*g*) When the food supply gives out what may the nomads do? (*h*) Why did China build the Great Wall?

3 (*a*) How did the Indians of the temperate grasslands make use of the buffalo? (*b*) Why did the buffalo migrate north and south each year?

4 (*a*) Why was grazing developed first in Texas? (*b*) What were the special hazards of the early cowboys?

5 How does the cattle industry of the plains today differ from that of sixty years ago?

6 List eight or more conditions that favor a high-grade beef industry

7 Answer the questions in the captions to the figures of this section.

## READINGS[1]

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"The Kurds and the Turkomans" — C, XX (1909), 749–760, 14, pp 127–134.

"The Land of Lambskins" — C, XXXVI (1919), 77–88

"On Marco Polo's Trail" — C, LIV (1928), 505–547 — especially the pictures

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"The Kirghiz Steppe" — 27, pp. 377–385; 7, IV, pp 450–452, 14, pp 158–162.

"Nomadic Herding Regions" — A, VIII (1932), 378–385

### II

"Ranch Life and Herding on the Plains" — Wister, O The Virginian, Grosset, New York, 1916, Canton, F M. Frontier Trails, Houghton-Mifflin, Boston, 1930

"Transfer of a Herd of Cattle from Texas to Montana in 1870" — Adams, A The Log of a Cowboy, Houghton-Mifflin, Boston, 1927.

[1] Numbers and letters refer to Selected References on pages 420–424

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"Cattle Ranches in Southwestern Texas" — 1, pp 121–134, A, VIII (1932), 67–80
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"Our Beef Supply" — 106, 1921, pp 245–264
"The Wild Herd Passes" — P, LX (February, 1933), 20 ff

## TOPICS FOR INVESTIGATION AND REPORT

I

"The Nomads of Mongolia" — C, XXXIX (1921), 507–551 — many pictures, LIV (1928), 532–545, LV (1929), 661–682, P, LXII (December, 1933), 32 ff
"A Plague of Locusts" — C, XX (1909), 755–760
"The Homes of the Nomads" — the references above, 8, pp. 17–25, 27, pp. 53–62
"The Animals of the Nomads and their Uses" — J, XIII (1923), 552–558, C, XX (1909), 749–760, 27, pp 377–385; 7, IV, pp 450–452; 14, pp. 158–162

II

"An Old Fashioned Round-up" — 9, pp 73–83, 20, I, pp 213–224
"A Season on a Cattle Ranch in Wyoming" — references above under Section II of Readings.
Contrast in a special paper cattle grazing in the Kirghiz steppes with that of the Great Plains of Wyoming
In a paper state the relationships shown between Figs. 8, 43, 45, and 68
"The Westward Migration of our Beef Industry" — 24, pp. 216–226, and other references.
"Sheep in Southeastern Ohio" — A, VII (1931), 263–272.

## § II — THE TEMPERATE GRASSLANDS OF THE SOUTHERN HEMISPHERE

### SOUTH AMERICAN TEMPERATE GRASSLANDS

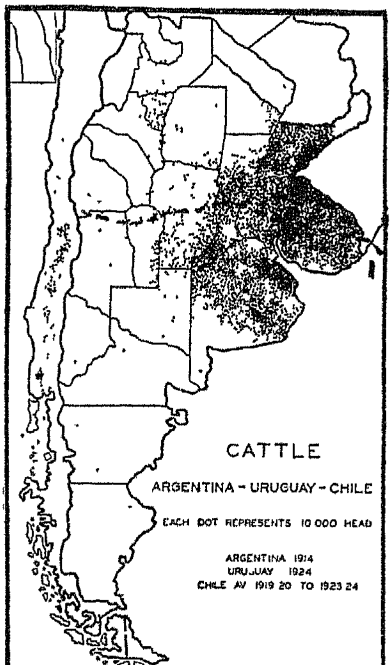
**The Pampa.** One of the world's finest grasslands lies in Argentina In some ways the advantages of the pampa surpass even those of our prairies The pampa supplies most of Argentina's exports of meat products which compose more than one-quarter of the world's total; Argentina supplies more than two-fifths of the world's beef exports.

**A Favorable Climate.** The climate greatly favors pampa grazing. In the east the rainfall amounts to about forty inches per year; towards the west about twenty inches. Most of the rain comes in the summer. How much is received in the winter? The mildness of winter permits outdoor grazing throughout the year, zero weather is practically unknown. Animals are rarely kept in barns.

The grasses grew so luxuriantly that in the early days a few cattle and horses that escaped from the Spaniards in 1535 soon developed into enormous herds. These for three centuries were hunted like wild beasts by the *gauchos* and gave rise to so large an industry that in 1816, a traveler said that, "The real wealth of the province of Buenos Aires was, and always will be, the trade in hides."

**Remoteness and Refrigeration.** Why did he think the pampa would

remain only a region of cattle and hides? Remoteness. As recently as 1894 the exports of wool from Argentina had a value as great as all crops sent abroad The pampa lies 6,000 miles from the markets of Europe, but it has one great advantage over our Great Plains It has the ocean on the eastern border and enjoys low-cost sea transportation (Fig 49). But this advantage could not be realized until the refrigerator ship came in 1877 Only non-perishable products, like wool, could stand the early long voyages




*From* South America *by* C J Jones

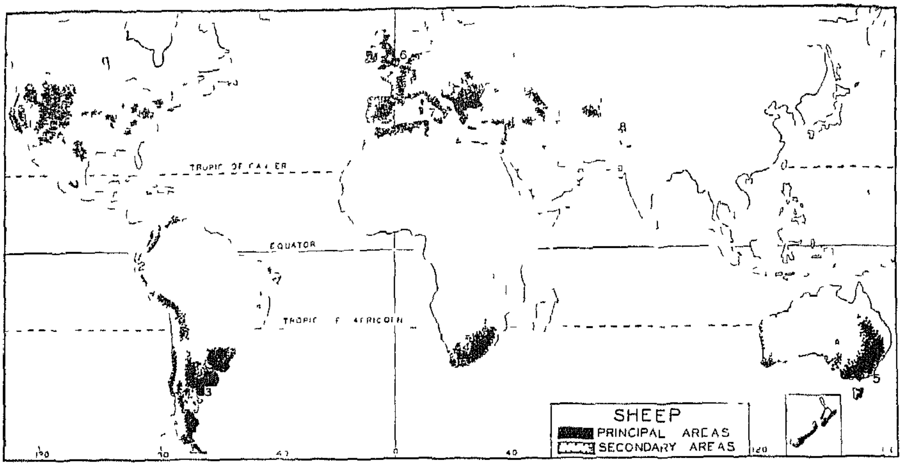
Distribution of Cattle, Southern South America

Fig 49 Southern limit of tick zone Cattle north of this line are dipped two or three times to kill the ticks on them, before being shipped to the packing plants Compare the cattle area with that on the map, page 86.

**Rise and Fall of Sheep Grazing in the Pampa.** After the fierce Indians of the plains were killed and railroads were built, the sheep industry progressed rapidly In 1895 the province of Buenos Aires, which comprises most of the pampa, had fifty-two million sheep, more sheep than all the United States ever had in one year But in 1930, that province had only fourteen million sheep. The story of the migration of the sheep industry in Argentina gives us a splendid illustration of the way the growth of population and transportation facilities affect grazing industries.

The refrigerator ships led to the decline of sheep grazing in the pampa Before 1877 practically no fresh meat could be shipped, live cattle reached Europe in poor condition and sheep could not stand such a voyage. The only meat products were *tasajo* or dried beef, canned beef, and beef extract. Now Argentina ships almost half a million tons of the highest grade chilled beef every year and a large quantity of frozen beef and frozen mutton. Europe provided such a good market that the cattle industry improved rapidly and replaced sheep.

**The Importance of Alfalfa.** The pampa has some of the finest cattle in the world (p. 22). This region now has many windmills and huge water tanks It has the world's largest acreage of alfalfa The American farmer fattens cattle on corn; the Argentine cattleman uses the nutritious alfalfa. This crop has a larger acreage than any other crop in Argentina, more than twenty million acres, or twice as much as in the United States. So valuable is it to the cattle industry that on a single ranch of



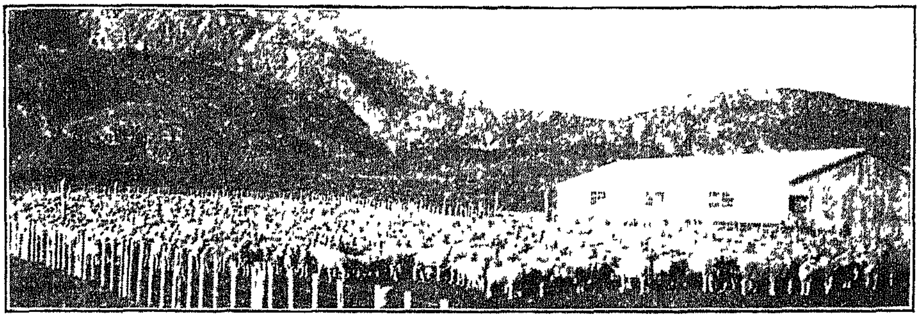

SHEEP AREAS OF THE WORLD

FIG 50 1, Western United States, 2, The Andes, 3, Southern South America, 4, South Africa, 5, Australia and New Zealand, 6, Northwest Europe, 7, The Mediterranean region, 8, Central Asia More than four-fifths of the wool exports of the world come from regions 3, 4, and 5

forty thousand acres more than half of the *estancia* may grow this flesh-making forage.

**Patagonia.** In Argentina and Chile the sheep industry, when displaced by cattle and other agricultural activities, had a better region to which to go than in the United States. In Argentina many sheep now graze in the lands between the Paraná and Uruguay rivers. Many more graze in Patagonia which is largely arid, cold, and isolated Sheep can graze in drier lands than cattle They get along with little water, eat many plants not liked by cattle, and can climb to mountain pastures Moreover, sheep products — wool, skins, tallow, and meat — have high value per unit of weight, so that they graze farther from transportation facilities than other animals In remote grazing regions this animal is the best possible source of income Thus we find the distant grassy plains of Patagonia, the Falkland Islands, Australia, and New Zealand great sheep grazing areas (Fig 50) Patagonia equals the combined size of California, Oregon, and Washington and over almost its entire extent it favors sheep more than any other animal Although many sheep browse in dry northern Patagonia, the southern part receives more rain, has better vegetation, has better shipping facilities and, therefore, has the majority of animals (Fig. 51) Southern Chile produces more than three-quarters of that country's exports of wool. Southern Patagonia produces about one-quarter of Argentina's wool exports and also ships quantities of frozen mutton In the Falkland Islands with similar conditions the people live almost entirely by sheep grazing

**Uruguay.** Not many important countries have so few trees as Uruguay. Only 3 per cent of its area lies in forests. The surface resembles the pampa to the west, but it is not quite so level. More than four-fifths of the



*Courtesy of Kohlmann*

SHEEP AT SHEARING SHED, SOUTHERN PATAGONIA

FIG 51 This remote, cool, moist and rough region is too cold for crops but it produces a fine wool How many people per square mile does the region have?

land is devoted to cattle and sheep grazing

The Uruguayan cattle industry has had a history much like that of the pampa For almost three centuries the cattle roamed the unfenced ranges and were hunted by the *gauchos*. Commercial products were hides and tallow Later dried beef, called *tasajo*, was made Thirty years ago Uruguay made more than one hundred million pounds of *tasajo* per year, most of it going to poor people in Brazil and the West Indies Now the quantity is much smaller, for the cattle are better and cattlemen are more interested in frozen and chilled beef Canned meat and meat extracts have declined greatly. Uruguay at present ranks next to Argentina as a beef exporter. As yet the Uruguayan cattle do not equal those of Argentina and most of the exports are frozen beef Several reasons account for this. Uruguay has severe droughts, one in 1916 killed one and a half million cattle. The country suffers also from the tick which gives cattle in the warmer north the Texas fever. Also Uruguay does not have valuable alfalfa pastures like those of the pampa. But the profitable sheep industry has retarded the rapid development of a high-grade cattle industry

Wool is Uruguay's principal product It supplies one-third of the value of the exports The sheep industry had a history similar to that of cattle In the early days there was no market for mutton because the people disliked it For years flocks of sheep were driven to brick kilns, there slaughtered, and their carcasses, stripped of the hide, flung into the furnace for fuel. Even now mutton has little value in Uruguay, the sheepmen being interested chiefly in producing fine fleeces.

Look at the sheep map of South America, p. 94, and the cattle map, p 86, what area near Uruguay, other than the pampa, has a grazing industry very much like that of Uruguay? Why do you find so many cattle in south Brazil? Why do nearly all the sheep of Brazil graze in south Brazil?

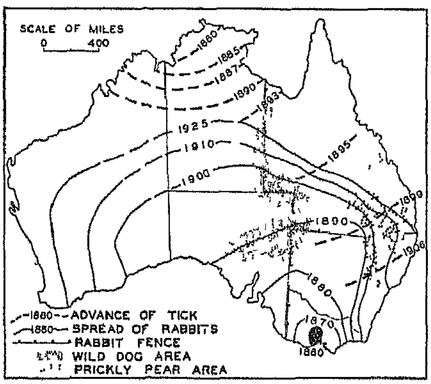
## GRASSLANDS OF AUSTRALIA AND NEW ZEALAND

The grazing industries of Australia are the best examples of the effect of remoteness on the use of extensive grasslands. This continent lies far-

thest from the leading importing countries of the Northern Hemisphere. More than one-third of the continent gets less than ten inches of rain

**Australia and Sheep.** For every person in Australia there are fifteen sheep. Australia has more than one hundred million sheep, this is more than the United States, Argentina, and Uruguay together have It exports one-third of the world's wool Australia has many favorable conditions for sheep grazing

Nearly half of the animals are kept in the higher lands in eastern New South Wales, where the rainfall in some sheep districts amounts to more than thirty inches In the moister lands many mutton sheep graze Westward wool sheep predominate. Practically no sheep are in the vast central desert because, unlike the deserts of the United States, this area




Distribution of Pests which Hinder Grazing in Australia

Fig 52 Why is the prickly pear considered a pest? How fast did rabbits spread? The tick? Prickly pear was introduced into Australia in 1777; it spread rapidly over large areas, making them useless. Recently the cochineal bug, which feeds on this plant and kills it, was introduced and is reclaiming the lands for the farmers Sixty per cent of the area over which the pear spread has been reclaimed

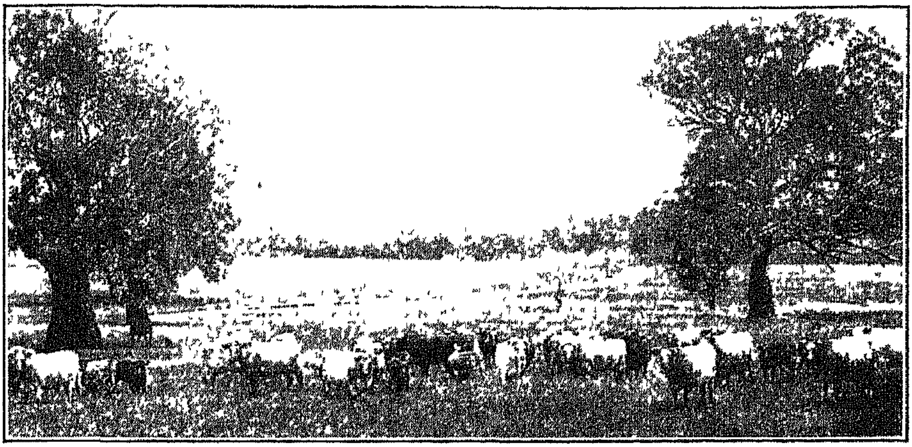
has very few irrigable districts or high mountains Moreover in the north, which is always hot (p. 15), the heat is too great for sheep and the grasses are better suited to cattle Practically everywhere the sheep spend all year in the open

**Pests.** Two important factors tend to keep sheep from the desert and hamper the industry in better regions (Fig 52) Both have cost enormous sums One is rabbits, millions of them. Before its settlement, Australia had no rabbits But about 1863 the fence of a rabbit breeder in Victoria was destroyed by fire and his rabbits escaped As these animals eat the forage of sheep, they soon became troublesome. Long fences were built to stop their spread, but despite the fences rabbits infest most of the continent One of these fences measures more than one thousand miles in length; Australia has more than one hundred thousand miles of such barriers Though a pest to the grazing people, the value of rabbit and hare skins exported was until 1930 much greater than that of mutton and lamb.

On the margins of the desert Australia has to fight another serious pest, wild dogs One ranch near Broken Hill lost forty-five thousand sheep in one year For a single wild dog scalp there is a bounty of $5 to $50 Wherever these blood-thirsty animals appear, the ranches pay more attention to cattle grazing because the larger animals have better means of defense.

**Cattle.** Australian cattle have much importance. The continent has two cattle per person and ranks after Argentina and Uruguay as an exporter of beef (Fig 53).

As you studied these grazing re-



Courtesy of Commonwealth of Australia

SHORTHORN CATTLE, SOUTH AUSTRALIA

FIG 53 What part of the world takes the exports of high-grade beef of Australia?

gions, you have noticed that most of them are different from the lands of nomadic peoples in Asia. In the early days the animals and peoples migrated considerably in these areas, but now the ranges have been fenced and large ranch headquarters established. The owners and cowboys have many comforts. good houses, newspapers, telephones, radios, and automobiles.

**New Zealand.** New Zealand does not have such extensive grazing lands as the continents, but it has a unique place in grazing industries for with only one and one-half million people, it is one of the most advanced countries. Practically all of its rank it owes to sheep and cattle. It has almost twenty sheep for every person and more than two cattle per person.

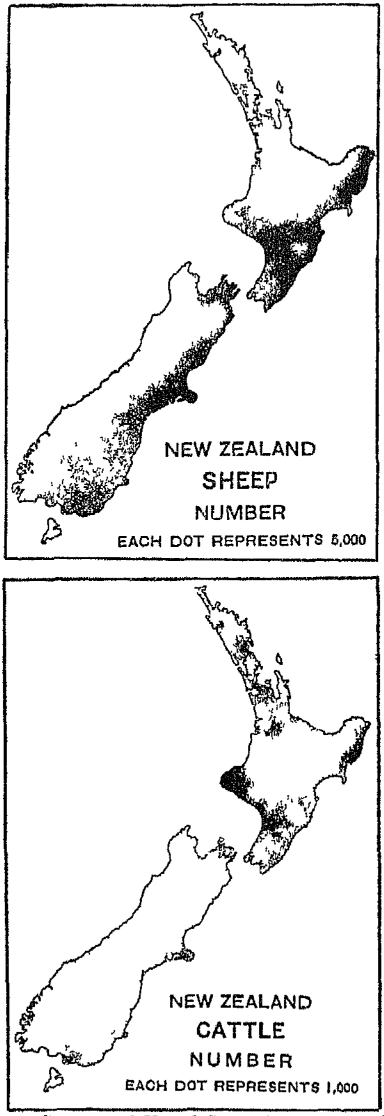
The climate favors the grazing of sheep and cattle. New Zealand does not experience disastrous droughts like Australia and Uruguay Sufficient rainfall is well distributed throughout the year. The animals always have plenty of water and grass Large supplies of hay are not necessary for mild temperatures permit grazing all year. Nine-tenths of the tilled land is planted to grass All areas are near the sea. Most of the sheep graze in the drier grasslands Which areas are dry? North Island has about four-fifths of the cattle and about one-half of the sheep (Fig 54)

The major exports in order of value are. wool, butter, frozen meats (the English say New Zealand frozen mutton is the best imported), cheese, hides, and skins—all animal products. These account for more than nine-tenths of the island's exports. Man found many geographic conditions favorable to grazing in New Zealand. When the steamship and later refrigeration came, New Zealand rapidly climbed to its present rank as one of the outstanding pastoral countries.

## SOUTH AFRICAN GRAZING

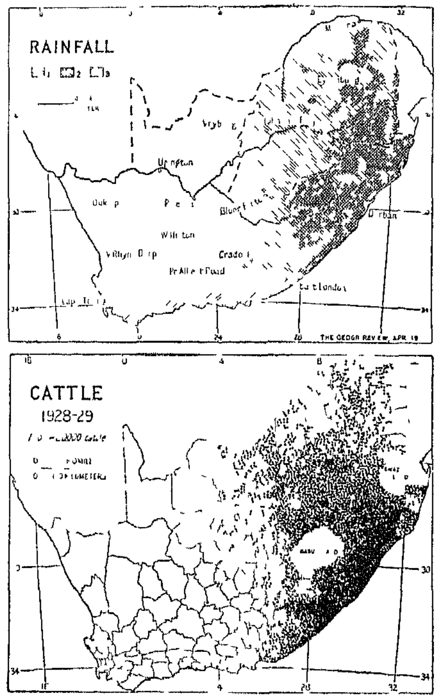
**The High Veld.** Near the southeastern edge of the African plateau lies another large temperate grass-

land area Most of eastern South Africa depends chiefly upon grazing, but the high veld has the leading rank It has broad level stretches of grassland, the tall grass growing thickly, trees occur only on elevations and on stream courses Before white men introduced their herds, millions of wild animals grazed here




*Courtesy of United States Department of Agriculture*

FIG 54 Compare these maps with the rainfall maps on pages 62 and 63, the relief map on pages 10–11, and the forest map on page 235, and explain the distribution of animals in New Zealand




*Courtesy of Geographical Review Published by the American Geographical Society*

RAINFALL AND CATTLE, SOUTH AFRICA

FIG 55 Rainfall and cattle density correspond closely (1) Summer rainfall of more than twenty inches (2) Summer rainfall of more than thirty inches (3) Winter rainfall East and north of the dotted line more than 60 per cent of the rain falls in the summer Compare with the sheep map on page 76

The veld receives more than twenty-five inches of rain per year (Fig 55). Most of the rain falls in the summer months, but droughts are not so bad as in Australia Compared to Australia, South Africa has one important handicap; the elevation of the veld, between four thousand and six thousand feet, causes a frost season of about one hundred days.

**Sheep Dominance.** Sheep constitute the outstanding industry. Cattle in considerable numbers are kept but the beef is of inferior quality, the cattlemen having paid little attention to improvement of breeds Cattle supply mainly local needs for food and draft animals The sheep are of fine quality and consist chiefly of the merino or wool type So well does the high veld agree with sheep that in the last twenty years South Africa has had the largest proportionate increase in sheep among all the important sheeplands Today it has more than forty million and ranks third as a wool exporter If we except gold, wool furnishes one-third of the value of the exports from South Africa

## EXERCISES

1 (*a*) Contrast the climate of the pampa with that of the northern Great Plains (*b*) List six or more factors that favor a great cattle industry in the pampa. (*c*) Why did the sheep industry develop early in the pampa? (*d*) Why did cattle and crops replace sheep in the pampa?

2. (*a*) In what other areas of Argentina do cattle graze? (*b*) Sheep?

3 (*a*) Why do more sheep graze in southern Patagonia than in northern Patagonia? (*b*) How much rain does southern Patagonia receive? (*c*) How is it distributed through the year? (*d*) Why do sheep of Patagonia produce better wool than those of northern Argentina?

4 Give all the reasons you can to explain why the chief industry of the Falkland Islands is sheep grazing

5 (*a*) What conditions make Uruguay a great grazing land? (*b*) Does Uruguay get more rain than most of the pampa?

6 Study the rainfall maps for Australia (*a*) Where are the chief sheep lands? (*b*) Why are there no sheep in central Australia?

7 (*a*) What great pests hinder the sheep industry? (*b*) Compare the distribution of sheep with that of cattle

8 (*a*) Contrast the rainfall of the Great Plains with that of New Zealand (*b*) In percentage of land in grasses what country does New Zealand resemble? (*c*) What are the chief exports of New Zealand?

9 What conditions make South Africa a great grazing land?

10 Why do few cattle graze in the western part of South Africa?

11. WOOL EXPORTS OF THE WORLD

(A recent year)

| *Country* | *Total (in pounds)* | *Percentage of world* |
|---|---|---|
| World | 2,130,666,560 | |
| Southern South America | | |
| Argentina | 297,022,000 | 13 9 |
| Uruguay | 172,296,740 | 8.1 |
| Southern Brazil | 16,195,520 | .7 |
| Chile | 21,002,960 | 9 |
| South Africa | 275,766,480 | 12.9 |
| Australia and New Zealand | 1,046,809,940 | 49.1 |

(*a*) What percentage of the wool exports come from remote regions of the Southern Hemisphere? (*b*) List all the factors that account for the importance of these regions as a group in the export of wool

12. As a review, contrast the grazing industry on the Kirghiz steppes with that of the pampa

13. Make a percentage chart of the wool exports of the world (table p. 81)

## AN EXTRA LESSON

An extra hour may be well spent on "The Sheep Industry of Australia" because of its importance and its relation to geographic factors In addition to the text use the following references: **24,** pp 274–282, **B,** XXVI (1927), 327–342, **A,** VI (1930), 215–219, 230, 234–237, **26,** pp 85–86, 131, 149–150, 235, 239–245, **7,** VI, pp 35–39, **C,** XXX (1916), 473–563, selected portions.

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"Sheep in the Southern Hemisphere" — **24,** pp 274–284.

"Grazing in South Africa" — **B,** XXIX (1930), 287–300, **7,** V, pp 282–287, 288–295, **J,** XXII (1932), 205–224, **C,** LIX (1931), 390 ff.

"Where our Wool Comes From" — **4,** pp 292–313

"A Day with the Argentine Gaucho" — **33,** No 16, pp 3–30, **C,** LXIV (1933), 449–491.

## TOPICS FOR INVESTIGATION AND REPORT

"Contrast the Four Sheep Regions of Argentina" — **17,** pp. 318–319, 341–342, 365–367, 382

"The Sheep Industry of South Chile and the Falkland Islands" — **17,** pp. 101–107, 124–127.

"The Pampa and its Beef Exports" — **17,** pp 310–313, 318, 375–380

"The Grazing Country of Uruguay" — **17,** pp. 399–408

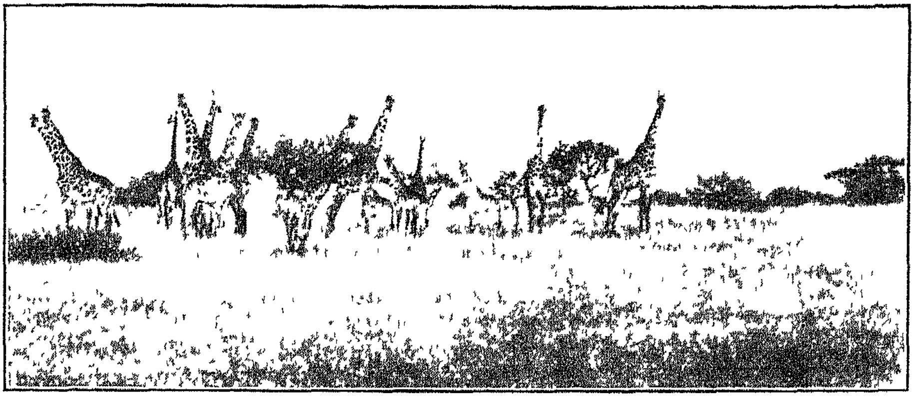
"Sheep Rearing in New Zealand" — **A,** VII (1931), 365–379; **7,** VI, pp. 89–93

"An Ostrich Farm in South Africa" — **7,** V, pp 288–295.

"The Rabbit Pest in Australia" — **C,** XXX (1916), 541–545 and other references on Australia

Most boys and girls will enjoy reading Hudson, W H: The Purple Land, Dutton & Co., New York, 1921.

[2] Numbers and letters refer to Selected References on pages 420–424



*Courtesy of Martin Johnson*

GIRAFFES ON THE GRASSLANDS OF AFRICA

FIG 56 Perhaps there are a million giraffes in Africa, they are only one of the many animals that thrive on the great grasslands of this continent.

## CHAPTER X

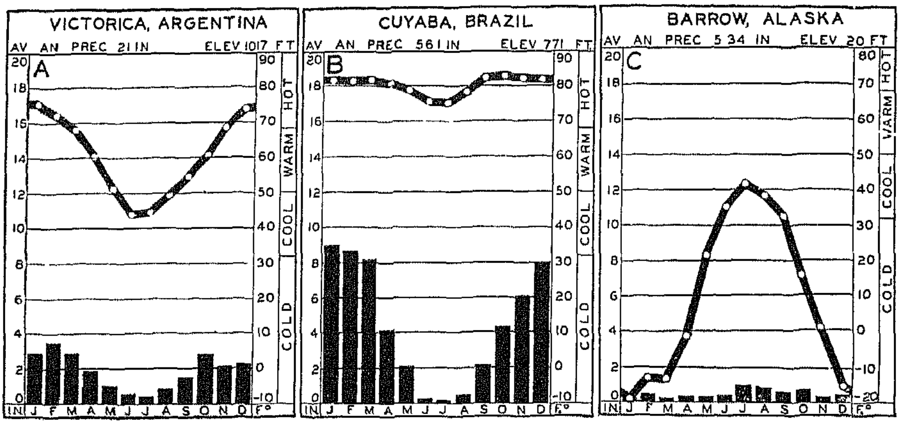
# GRAZING IN THE SAVANNAS

Many people call the savannas the grazing reserves of the future. But why do they think of the savannas as important grazing areas only in the future? We know that this type of vegetation supports millions of cattle, but the animals do not make good beef (Fig. 56). Savannas have many handicaps.

Climate gives savannas their outstanding handicap Savannas receive more rainfall than temperate grasslands, but the difference between rainy and dry seasons is much greater. In the dry season, drought constantly hinders plant, animal, and man (Fig. 57). High temperatures intensify the effects of little rainfall in this season In the wet season high temperatures cause a large growth of grasses. This distribution of rain and high temperatures explains the natural vegetation, which consists of broad areas of tall coarse grasses interspersed with scattered trees or groves of trees.

On pp. 60–61 locate two large savannas in South America, two in Africa, and one in Australia What is the dry season in the campos? In the llanos? In the sudan? The savanna northwest of the pampa is the chaco When is its dry season? What area lies to the north of the sudan? Why is there no large desert north of the llanos? What area is southwest of the savannas of Australia? Of southern Africa? Of the chaco? What kind of lands lie on the border of the savannas toward the Equator? Why? What savannas are in lowlands? On plateaus? Are savannas regions of dense, medium, or sparse population?

Another handicap of savannas is disease All the savannas have cattle ticks which give the cattle Texas fever; they have hoof and mouth disease, carbuncle, and others. Diseases




CLIMATIC CHARTS

FIG 57 In interpreting the relation of temperature and rainfall to the pasture lands and to crops these charts are very helpful The figures on the right-hand side are temperatures in degrees Fahrenheit, those on the left, precipitation in inches The black lines at the bottom show the mean monthly precipitation, the small circles connected by the black line across the chart near the top show the mean monthly temperatures.

Chart A shows a rainfall régime favorable for wheat Chart B is of a station in the campos of Brazil Cuyaba gets a total of fifty-six inches of rain per year, January gets nearly nine inches, but June, July, and August together get about one inch The drought period of these months is the real cause of the savanna, during these months all vegetation dries up because of the low rainfall and high temperatures Notice the rainfall on Chart C, in the entire year Barrow gets less than six inches, but there it is moist all the time because of the low temperatures (pages 14 and 15).

Notice the temperature curve of Cuyaba Cuyaba is always hot, there is little change of temperature from month to month Why? Contrast the temperature curve for Barrow, for Victorica Plants grow most rapidly during hot and warm months, Cuyaba has a growing season of twelve months, Victorica has about nine months, while at Barrow only mosses and grasses of the tundra grow How long is the growing season in Cuba (Chart A, page 109), in Illinois (Chart B, page 189)? Notice and explain why July has the lowest temperature at Cuyaba and January at Barrow.

Note In class discussions the teacher should make frequent use of the climatic charts and maps

produced by insects impede man's use of the savannas even more than the climate. In places where cattlemen take pains to get rid of insect pests, rather good cattle are raised. The problems in the African savannas are greater than those in South America or Australia There the dread tse-tse fly, which lives only in areas of low altitude, attacks both man and beast. In most of the savannas snakes and wild animals do damage. Also it would not pay to build railways into the savannas to bring out poor-grade cattle; good cattle cannot walk long distances to market.

Despite these disadvantages, savannas have much value. The dry season is a serious problem, but men know how to make even a desert bloom. Moreover, the grass furnishes forage whether green or dry Besides, the trees provide a shelter from the hot sun. And the year-long warmth makes barns unnecessary. Since the more easily utilized temperate grasslands have begun to feel the effects of increasing population,

spread of crops, and decrease in animal populations, we ought to expect the savannas to produce more animals in the future

THE SAVANNAS OF AFRICA

Savannas cover more than a third of Africa. They stretch in a great arc from the Atlantic eastward nearly to the Indian Ocean and then southward to the tip of the continent (p 61) The savannas agree roughly with the belt having from twenty-five to fifty inches annual precipitation. Study the seasonal rainfall maps of these savannas

For thousands of years the natives of these lands have had a grazing industry Some of them depend almost entirely on their herds Cattle are by far the principal animal. Some tribes keep a few hair sheep for milk, meat, and skins, the climate is too warm for wool sheep. Most tribes keep goats, pigs, and chickens Cattle stand the heat better than the other animals, can travel better through the grasses, some of which may be ten feet high, can carry large loads, and can defend themselves. The last point is very significant for the savannas are the habitat for lions, leopards, cheetahs, jackals, hyenas, and hunting dogs. These carnivora feed largely on the numerous grass-eating animals, such as the giraffe, zebra, eland, steinbok, gazelle, and antelope, but they constitute a menace to domestic animals. So well are the cattle able to defend themselves that in many districts a young lion or leopard, which foolishly comes too close to a herd, often is stamped to death by the rushing herd

From a commercial viewpoint, the savanna cattle industry has as yet little importance Nevertheless, many countries have recently had large increases in cattle mainly under the direction of white herders In the last twenty years, Africa's cattle increased from about thirty to forty-five million. The increase has occurred chiefly in the savannas of the British possessions in the eastern and southern part of the continent However, as yet, the principal export products are hides and wool

THE SAVANNAS OF SOUTH AMERICA

The savannas of South America do not cover so large an area as those in Africa, but they are more valuable. When it becomes necessary to raise more cattle in savannas, South America will probably witness a rapid growth A major advantage is found in the transportation possibilities here, for large parts of these areas lie near the sea and other sections have rivers (Fig 58) They do not have so many wild animals Also, the type of population is of higher rank than the semi-nomadic and nomadic natives of the African savannas When Europeans came to South America, the Indians had no cattle and the industry was established by white men. Therefore, even in very remote districts we find cattle grazing on a commercial scale, but chiefly in the campos, the chaco, the llanos, and the Bolívar savannas.

**The Campos.** In the campos practically all of the cattle graze east of the Paraguay River, many are in the southern part of the campos. The cattle industry here had an early start because of the need for meat in the early gold and diamond mines of interior Brazil. Although floods some-


*From* SOUTH AMERICA *by* C F *Jones*

FIG 58 1, Bolívar savannas, 2, Llanos, 3, Campos, 4, Plateau of Eastern Brazil; 5, South Brazil, 6, Uruguay, 7, The pampa, 8, Southern limit of cattle ticks Compare with the map of grazing regions Why are so many cattle in eastern Brazil?

times cause much damage, the swampy meadows about the headwaters of the Paraguay River constitute the chief district because the grasses remain good in the dry season and the river affords a highway to the south. The eastern parts of the region now have more animals than the western. What reasons for this do the world maps of relief and population suggest? Two railway lines connect the east with São Paulo, a region having many cattle also (Fig. 59). What products probably come from the herds of the eastern part of the campos? From those of São Paulo? What other parts of Brazil have many cattle?

**The Gran Chaco.** Southwest of the campos lies a large savanna, called the chaco Only the eastern and southern margins of the chaco have any cattle. The east has the Paraguay River for transportation, it also has large camps that produce tannin extract from the quebracho

*Courtesy of Ernest G Holt*

CATTLE PEN IN THE CAMPOS, BRAZIL

FIG 59 Notice the hump on the shoulders of some of the animals Because zebu cattle are immune from the Texas fever, zebu bulls have been used with native cows in an attempt to get an animal good for meat and immune from Texas fever Zebu cattle are good draft animals but make poor meat

tree. How do the camps use cattle? The southern margin is near the Paraná River, the railways, and slaughtering plants of the pampa. The cattle are of poor grade for the region has many handicaps including floods, lack of salt, many diseases, locusts, ticks, and droughts. No cattle can be shipped into the pampa from the chaco until they have been dipped two or three times in an arsenic solution to rid them of ticks.

**The Llanos.** Once the llanos savannas were regarded as among the most valuable of new grazing lands. It was thought that a great cattle industry would surely develop on these vast plains covered mainly with grasses. Also the region lies nearer Europe than Argentina by a full week But these features lose much of their value because of the climate. In the rainy season floods drive the cattle to the low hills where the animals soon eat all available grasses. Many perish while attempting to reach hummocks of fresh grass. After the floods, immense swamps remain and breed many kinds of destructive germs Later the tick begins its ravages In a few months the plains experience a serious shortage of water, for the warm, moisture-gathering trade winds sweep over them In the dry season the grasses become so poor that irrigated pastures of alfalfa or grass must be used; these lie near the Andes and from them the cattle move over the mountains on foot to market Most of the three

million cattle are confined to the alluvial plains of the Orinoco and Apure rivers where the best stand of grass grows

**The Bolívar Savannas.** In northern Colombia lie several thousand square miles of the most useful savannas in South America. The largest district is known as the Bolívar savannas In many ways these resemble other savannas, but the grasses are better and so are the transportation facilities This region stands out very noticeably in a map of the distribution of cattle, in a relatively small area more than two million cattle graze Since the meat is a poor grade none of it goes to great foreign markets What great river highway serves this region?

## THE SAVANNAS OF AUSTRALIA

The Australian savannas extend across the northern part of the continent in a great crescent and show very clearly the effects of the seasonal distribution of rainfall. While they have shortcomings similar to those of other savannas, they have reached a higher state of development The eastern savannas, which are the region of the gigantic eucalyptus trees, not only have many cattle but they have some of the best farmlands in Australia. Farther west and toward the dry interior, the savannas become less rich and the trees are scrubby. Cattle show a corresponding thinning out toward the west (Fig 60).

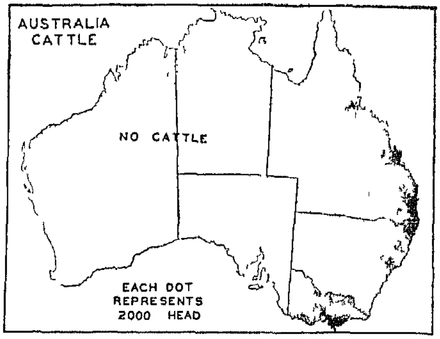



FIG 60 Where are most of the cattle of northern Australia (page 61)? Why are there no cattle in the central part of Australia? What are the chief uses of cattle in southeastern Australia? In the north?

The cattle industry has made considerable headway here because of several reasons The area had practically no aborigines to impede white men's progress Much of the land lies near the coast and several railroads in Queensland tap the grazing districts. The government gives much aid to the cattlemen, because in a land of so much desert the greatest possible use must be made of the favorable areas It expends large sums of money in maintaining the routes along which cattle travel to market It builds fences to check the spread of rabbits, it works to check the spread of the tick and pays bounties for wild dogs. Hundreds of tanks collect rain water to supplement natural watering spots and wells. The government also maintains supplies of feed at certain places.

## EXERCISES

1\. (*a*) Answer the questions on the first and second pages of this chapter. (*b*) List the handicaps of the savannas for great grazing industries.

2\. (*a*) Contrast grazing in the Sudan Chaco near the eastern and southern margins? (*c*) What handicaps have the llanos? (*d*) Why is none of the meat shipped from these savannas to great foreign markets?

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"The Campos"— 17, pp 44–45, 65, 486–494, G, XLVI (1918), 759–771; 6, pp. 211–214

"The Llanos"— 17, pp 45, 64, 605–607, 647–655, F, XXII (1924), 45–56, K, CXXVIII (1914), 813–825, 7, II, 365–370, 6, pp. 324–334

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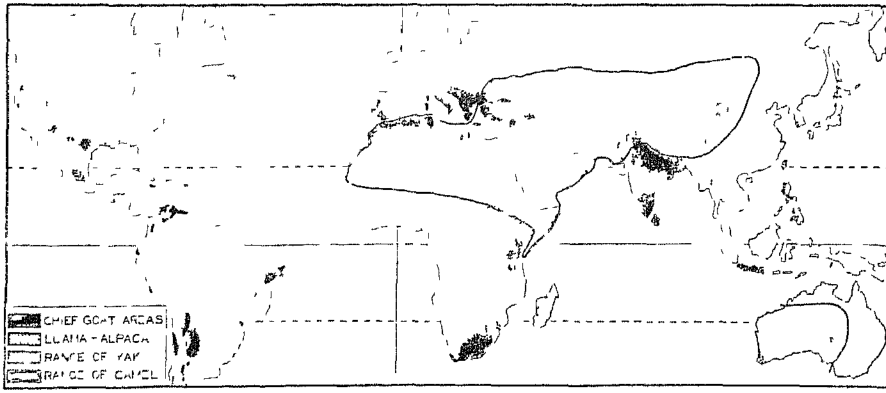
"The Lion, Prowler of the Veldt"— L, II (October, 1932), 19–23

Any boy or girl will enjoy reading Patterson, J H · The Man-Eaters of Tsavo (Macmillan, New York, 1907), a thrilling story of two lions.

[1] Numbers and letters refer to Selected References on pages 420–424.




ANIMALS OF MOUNTAIN OR LOW RAINFALL REGIONS

FIG 61 Which regions shown on this map have a rainfall of more than twenty inches? Explain why they have so many animals

## CHAPTER XI

# GRAZING IN MOUNTAIN AREAS

Tibet suggests yaks and sheep Switzerland suggests mountain pastures dotted with cattle Pictures of the Rocky Mountains often show flocks of sheep in meadows bordered by forests on one side and majestic mountains on the other In a view of pastures in the central Andes we see sheep, llamas, or alpacas In rugged mountains people tend animals chiefly for milk, butter, cheese, wool, and transportation, meat is secondary Several factors help to explain the grazing of many animals in mountains (Fig 61)

### MOUNTAIN GRAZING IN ASIA

**Tibet.** The inhabitants of Tibet live in one of the world's most inhospitable regions Much of their land is nearer the Equator than Georgia, but it lies at heights of ten thousand to seventeen thousand feet. It is a vast area of plateaus. Snow may fall in any month from September to May and frost is not uncommon in the middle of summer. Most of the time strong dry winds sweep over the land How much rain does Tibet get in each season (pp. 62–63)? Travel in all directions encounters many obstacles. Northward the descent to lowlands is almost impossible in some places and hard practically everywhere Eastward several long valleys extend into the plateau. These carry much of the trade between China and Tibet, but the trails are difficult and long. Southward and westward the Himalayas are an almost insuperable barrier across the trader's path The descent to the lowlands is precipitous, but in the face of great hardships considerable trade moves Under such circumstances, the Tibetan of the plateaus can support himself only by raising animals.

Some Tibetans live in the valleys north of the Himalayas. These dis-

*Courtesy of Publishers' Photo Service*

A BEDOUIN CAMP SYRIA

FIG 62 Compare the range of the camel (page 90) with the rainfall maps (pages 62–63) List the animal products of this region Locate on a map the following places: Syria; Anatolia, Palestine

tricts receive more rain than the plateaus and have access to the mountain snows which are of value in irrigation In sheltered spots barley, wheat, and a few vegetables can be raised This produce plays an important part in the life of all Tibetans The Tibetans of the plateaus trade their animal products for products of the valley fields

Although the plateau people use some of the food from the valleys, they depend almost entirely on their animals, chiefly yaks and sheep. We know already how sheep help remote lands. The yak is even more valuable here. It works at high altitudes better than any other animal It serves as a draft animal, a beast of burden, and a saddle animal It produces rich yellowish milk from which the Tibetans make quantities of butter and cheese. Its long silky hairs have many uses Its meat is good, likewise its hide.

**Grazing in Southwestern Asia.** For more than two thousand miles west of Tibet stretch many plateaus and mountains. Although there are exceptions, chiefly about the margins, the area has one outstanding feature It is dry. How much rain does the region get? Some places have only three or four rains a year. Everywhere, except for the highest mountains, there is a long dry season and a short wet season. Uncertainty of rains makes this a wretched land. When rains fail to come or do not last long enough, famine kills man and

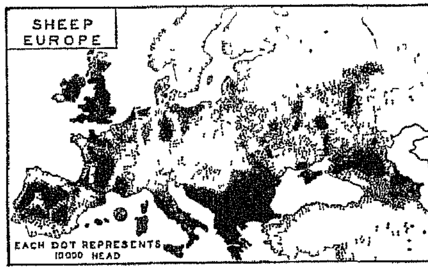
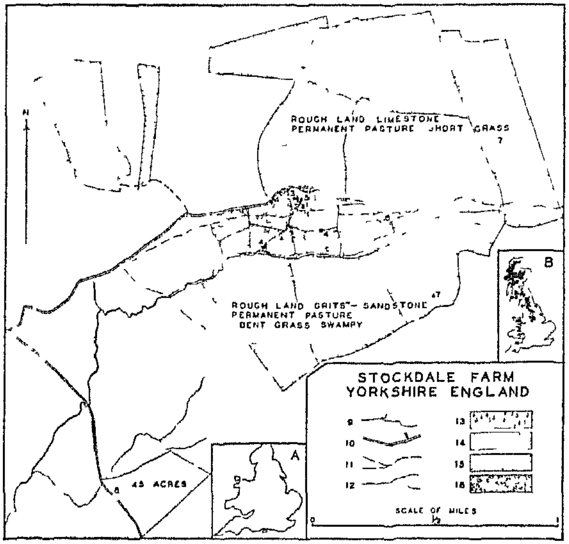



FIG 63 Sheep are especially adapted to the hilly dry areas around the Mediterranean Sea Also, they are numerous in the hilly wet lands of the British Isles and fit well into root-crop mixed farming in northwestern Europe.




*Drawn from information supplied by H King*

STOCKDALE FARM, YORKSHIRE, ENGLAND

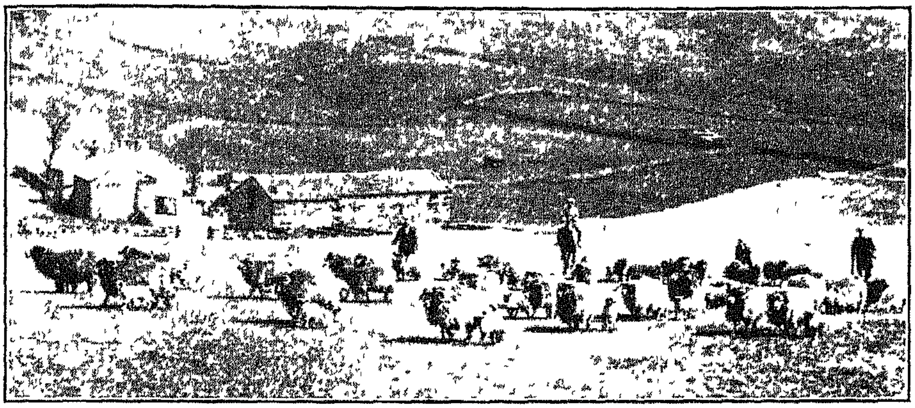
FIG 64 1, House 2, Cattle and sheep stable, above stables are hay mow and wool storage 3, Cattle and sheep stable, sheep pen, above stables are hay mow and wool storage 4, Field hay barns and corrals 5, Well 6, Spring 7, Highest points on the farm, 1,800 feet 8, Lowest point on the farm, 999 feet 9, Field borders and stone fences 10, Roadway 11, Paths 12, Streams 13, Small clump of trees 14, Permanent pasture 15, Improved permanent pasture 16, Meadows, permanent grass mowed for hay and pastured at intervals during the year Inset A shows the location of Stockdale Farm in England Inset B gives the distribution of moorlands in Great Britain, the areas of this type of grazing What is the difference in elevation between the highest and lowest part of the farm?

beast As many as possible of the inhabitants live in the higher, better-watered parts, where irrigation may be practiced. Not nearly enough land is available for all the population to live on farms. Animals make it possible for men to live in an otherwise uninhabitable land.

The production of Persian rugs is an indication of the importance of sheep in Persia and lands to the west, which profit by selling their products as Persian. The city of Angora in Anatolia gives its name to the valuable goat bearing long silky hair, known as mohair "The Lord is my shepherd" indicates the significance of sheep in these dry mountainous lands. The camel is more important here than elsewhere, except in the Sahara (Fig 62) The camel is strong, tall, and can endure great hardships, it can travel faster than other beasts of burden It can live for days without water or feed, its feet are big and padded so they do not sink into the sands and the hot ground does not crack or burn the feet. The nostrils and eyes are protected by fine hairs from the dust and sand

In many sections the people are nomadic. They graze their animals in summer in the mountains and plateaus which have pastures When snows come to the higher altitudes, these nomads, with all their belongings, move to the lower slopes and margins of deserts to find winter pastures. The migrations follow a systematic plan. When the flocks have eaten the grass in one pasture they move to others in regular order determined by the chief of the tribe

**Grazing in Mediterranean Lands.** About the Mediterranean Sea lies one of the world's major sheep and goat grazing areas The countries bordering the Mediterranean have more sheep than Australia and nearly one-third of the goats of the world (pp 76 and 90) The climate ex-



Courtesy of Yorkshire Post

THE LAMBING SEASON, STOCKDALE FARM

FIG 65 This picture was taken from the hill north of the house (Fig 64) looking south The sheep are the Swaledale breed, a hardy sheep adapted to cold damp weather on the stony, rough, and swampy moorland seen in the distance Note the stone buildings, sheep pens, fences, and the meadows back of the buildings Why is all the land in pasture or meadow? What parts of Great Britain have rough grazing land? Fifty-two per cent of the area of Scotland is rough grazing land

cels that in southwestern Asia, but there is a long dry season. A large part of each of these countries is mountainous.

Much land is too dry and the forage too poor even for sheep (Fig. 63). In such areas are many goats. They can live on such scanty and unappetizing rations that even in many towns almost every family has a flock. They are the principal dairy animal for millions of people, especially in Greece, while pictures of goats being milked at the customer's door in Spain are familiar to all of us

**Grazing in the Moorlands of Great Britain.** In striking contrast to the grazing in the arid Mediterranean lands is the grazing industry of the mountains of Great Britain

Fig 64 shows a farm in the moorlands of England The farm contains 1,085 acres: 900 acres of rough hill pasture, 75 acres of improved pasture, 65 acres of meadow set apart for hay and pasture, and 45 acres farther down the slopes for hay and food crops[1] The farm buildings are at an elevation of 1,300 feet. At this elevation few crops are grown because of the cold damp climate and thin infertile soil, note that the garden is on the lowest field of the farm. The farm supports about seven hundred sheep and their lambs and about one hundred cattle Only a few milch cows are kept for home use. The sheep and cattle are special breeds adapted to the cold rough moorlands (Fig 65). From them the farmer gets his income by selling wool, lambs, and beef cattle.

The one occupation is grazing. The farmer spends nearly all of his time caring for his stock, harvesting the

[1] These pasture lands are very important to Great Britain, rough grazing land occupies 32 per cent and permanent pasture another 30 per cent of the land of Great Britain. — Stamp, L.D., *The British Isles*, p. 109.


*From* SOUTH AMERICA *by C F Jones*

DISTRIBUTION OF SHEEP IN SOUTH AMERICA

FIG 66 1, South Brazil 2, Uruguay 3, The pampas 4, Patagonia and south Chile 5, The Andes 6, Mediterranean Chile From maps and text, list in detail the factors explaining the distribution of sheep in South America.

hay, and tending the garden. Spring is a very busy season with shearing the sheep, storing the wool, and taking care of the young lambs. Ewes graze on the moorland all the year, except for short periods in very cold or stormy weather and at the time the lambs are born. The moorlands are rough, stony, and swampy, grasses on the limestone areas are better than on sandstone areas. As the lambs cannot stand the coldest winter weather on the moorland, the farmer sells most of them in the fall to farmers at lower elevations, who raise root crops to fatten the lambs before sending them to the butcher. The lambs, which the farmer wishes to keep to replace old ewes, are fed in barns during the first winter. In the spring the farmer buys about one hundred cattle from western Great Britain and Ireland; he grazes them on improved pastures and on the meadows after the hay is put in the barn, in the fall he sells them to farmers who can fatten them on

root and other crops Because of the rough stony infertile soil and the cold damp climate, persons living in the moorland have to be herders

**South American Mountain Grazing.** In the Andes the people, mostly poor Indians, graze many sheep, llamas, alpacas, and some cattle Much of the region is ten thousand feet or more above the sea Is it hot or cold (p 14)? Most of the grasses are short temperate grasses. The Indians do not have to depend entirely on the animals for they raise potatoes and barley. In summer they take the animals high into the mountains

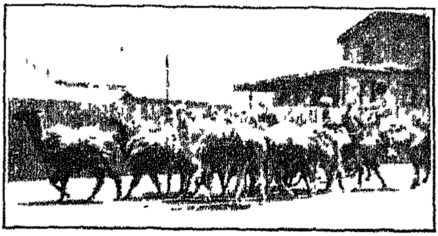


FIG. 67 The llama, an excellent beast of burden, subsists on little forage as it moves along the rough trails, does without water for days, and carries one hundred to one hundred fifty pounds

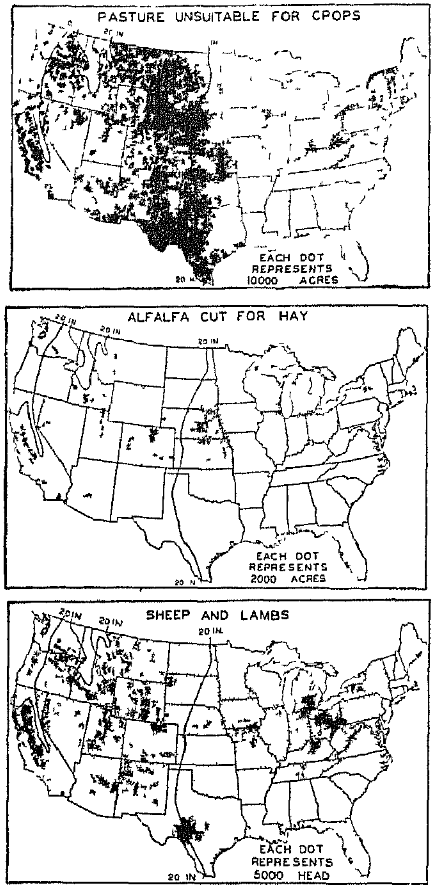
Sheep are valuable to the Indians (Fig 66). They supply food and wool from which the Indians make most of their clothing. The Indians at night sleep on sheep pelts in their huts. The sheep range from black to white in color, this is a handicap in marketing wool but aids the Indian in making striped clothing without dyes. Near each hut is a stone or mud corral for the sheep and other animals at night

Before the Indians had sheep, they tamed the llama, a member of the camel family about four feet high (Fig. 67). Llamas like the high cold pastures. They walk long distances with little food and water They carry most of the Indians' burdens. They produce wool, meat, leather, bone, and even fuel The Indian could hardly get along without llamas

The alpaca seems to do best from twelve to sixteen thousand feet above the sea It does not carry burdens and requires better forage than the llama Its fine long silky hair is very valuable for making high-grade woolen goods. Peru has more than one and one-half million alpacas and exports about $2,000,000 worth of alpaca wool every year.

**Grazing in the Mountains of Western United States.** In the dry mountainous regions of western United States, sheep again show how valuable they are in lands of few agricultural resources (Fig 68). Areas west of the Great Plains now have two-thirds of the sheep of the country. They supply eastern markets with wool and meat

Being pushed from the best lands by cattle, the industry is the most nomadic of American grazing industries Shepherds accompany the flocks in high mountain pastures for months during the summer Much summer grazing is in national forests leased by sheepmen In the winter, flocks descend to irrigated valleys where they feed largely on alfalfa, or to desert margins where they graze on shrubs. Near Salt Lake oasis, sheep move each season between the mountains east of the lake to the desert west of the lake, a distance of two hundred miles or more each way (Fig. 69). They move in flocks up to three thousand head. They require from one to three weeks to trail from the mountains to the desert and even more to return By



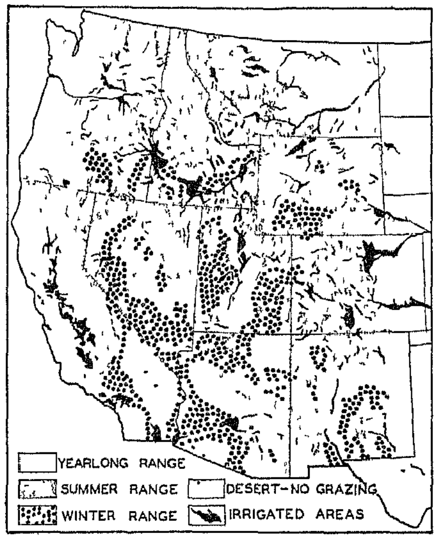

*After United States Department of Agriculture*

PASTURE LAND, ALFALFA, AND SHEEP

FIG 68 Two-thirds of the sheep and lambs are in the grazing area of the mountains and plains where much of the pasture land is unsuitable for crops What relation is there between the twenty-inch rainfall line and the density of dots on these maps? Relief and the density of the dots?

this seasonal change they are kept in good forage, cool weather, and have ample water both winter and summer

Wool is the most valuable product of the flocks, but lambs also bring good returns Large numbers of lambs are shipped from the ranges to the eastern agricultural regions for fattening prior to marketing In actual weight this movement is small, as the people of the United States eat comparatively little lamb and mutton, only five pounds per person each year




SEASONAL GRAZING RANGES, WESTERN UNITED STATES

FIG 69 The summer range is found chiefly in what areas? The winter range? Note the relation between irrigated areas and year-long range

## EXERCISES

1. (*a*) What large mountain areas border the Tibetan plateau? (*b*) What eastward valleys carry the trade to China? (*c*) What factors cause the Tibetans to depend almost entirely upon animals for a living? (*d*) Is the population dense? (*e*) What crops do some of them raise? (*f*) What use is made of the yak?

2. From the maps work out the chief characteristics of southwestern Asia. (*a*) Name three large plateaus of this region (p. 11). (*b*) What well-known valleys are there? (*c*) What is its rain-

fall? (*d*) Vegetation? (*e*) Why do so many people live by grazing? (*f*) How does grazing here differ from that in the pampa? (*g*) List all the conditions that make the people nomadic. (*h*) List the conditions that make the camel a valuable animal here

3 (*a*) How is the rainfall distributed in the Mediterranean region (pp 62 and 63)? (*b*) Why is grazing of sheep and goats important? (*c*) Contrast grazing here with that in Patagonia

4 (*a*) Explain the distribution of sheep in southern Europe (p. 91) (*b*) Of goats (p 90)

5 Outline in detail the relation of grazing in the moorlands of England to physical conditions

6. (*a*) What countries have parts of the mountain grazing areas of South America? (*b*) Do these mountain areas have more people than the regions directly east of them? Why? (*c*) Why are sheep valuable to the Indian? (*d*) Of what value is the llama? (*e*) The alpaca?

7 Study the sheep map of South America (p 94) In what three types of lands are sheep grazed in large numbers?

8 (*a*) On the sheep map of the United States pick out the chief sheep areas of the west (p 96) (*b*) Why do the sheep graze in the national forests and high areas in the summer? (*c*) In the valleys or on desert margins in the winter? (*d*) List all the conditions you can to explain this movement of animals.

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[2] Numbers and letters refer to Selected References on pages 420–424.

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# PART IV

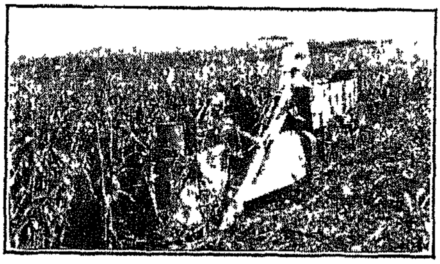
# THE PLACE OF FARMING IN HUMAN ACTIVITIES

## CHAPTER XII

# FARMING AS AN OCCUPATION

**Farming a Necessary Occupation.** We cannot get along without farms No other occupation supports so many people. We have seen how the Eskimos, the Laplanders, and other peoples live without farming They are fishermen, hunters, and gatherers of wild foods. Their self-sufficient occupations do not support great populations Even in the forest, mineral, and manufacturing industries farming is a necessity since none of these is self-sufficing All require food for the workers and raw materials for the factories from the populous farming lands which buy their wares (Fig 70). Where are the great farming regions?

**Farming and Commerce.** The need for food and raw materials is the main reason for much of the world's commerce today This explains the huge trade between sparsely populated lands like Argentina and Australia and densely populated lands like England, in other words, between farming and industrial lands Most of Cuba's prosperity depends on growing sugar and selling it to the United States and other lands The wheat farmers of Kansas depend largely on the factory workers of eastern United States and other countries Few areas can develop large farming industries without entering commerce



*Courtesy of International Harvester Company*

A Modern Corn Picker in Operation in Illinois

Fig 70 This farmer lives in one of the great farming regions of the world Large level areas of land make possible the use of such farm equipment The two-row picker will pick and husk sixteen acres of corn in a ten-hour day, as much as sixteen men of average skill can do This is the most modern method of husking corn Most of the corn, however, is still husked by hand

**Types of Farming** Before countries like England greatly expanded the world's commerce there was one principal type of farming in which the farmer produced most of his needs This method is called subsistence farming Early American history is full of examples of how the farmers lived with little commerce except a crude type of barter with neighbors. The settlers brought a knowledge of farming with them from Europe There the people learned of farming from the Mediterranean regions, perhaps Syria and Egypt Why have the Chinese been called "Farmers of Forty Centuries"? Farming is an old industry in some parts of the world and very new in others As a result we find several types of farming These have developed because of differences in regions, peoples, and the growth of populations. In some types

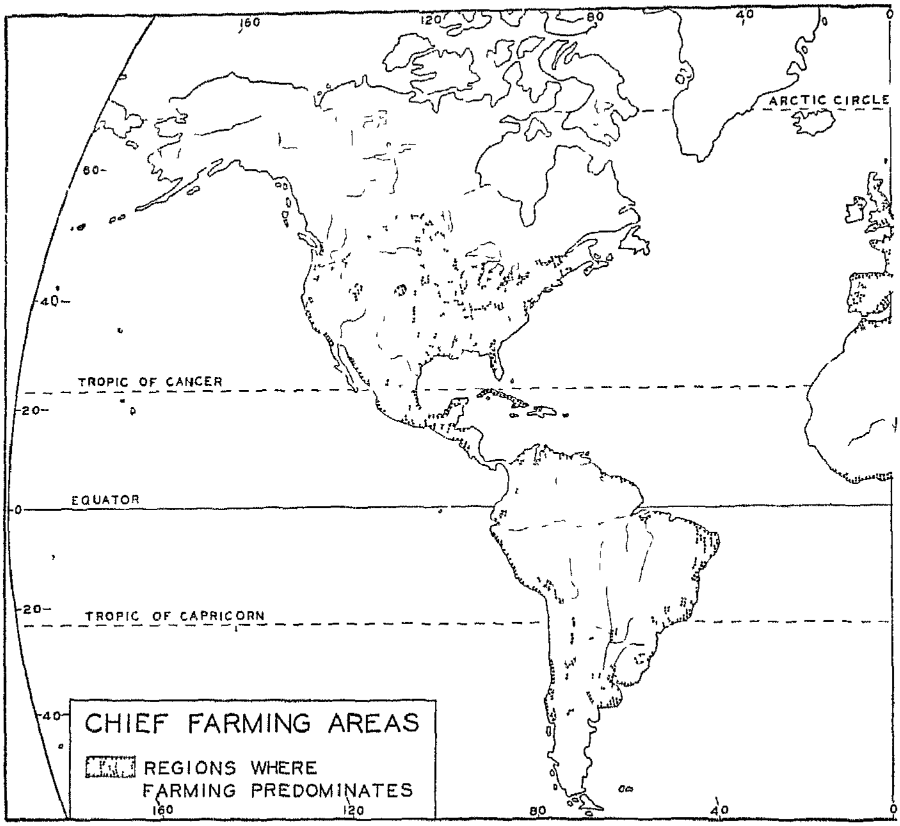


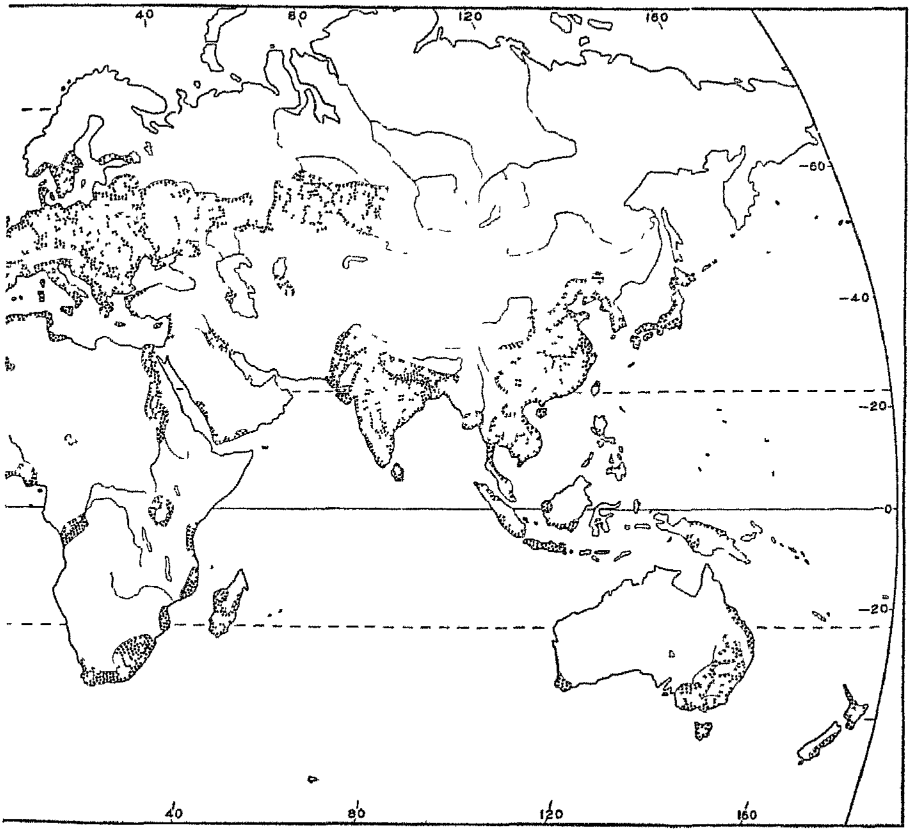

FIG 71 How many large farming areas are there in the Northern Hemisphere? areas of the Northern Hemisphere is more important in food and materials produced

the farmers produce many things, but in others they produce only one crop, hoping to make enough money from it to buy what they need of other materials.

We recognize six main types of farming 1 plantation farming in the tropics; 2. farming in monsoon lands, 3. farming in regions of Mediterranean climate; 4 cereal farming in semiarid plains; 5. mixed farming in temperate lands, 6 dairy farming in humid temperate lands.

**Population and Farming.** Farming is the world's biggest business. It has more workers than any other occupation (Fig. 71) Even in great industrial regions many people are farmers. New lands produce food and materials for the industrial regions and their factories. In Japan nearly half of the people are farmers, in China nearly 80 per cent. In new regions fewer people take up farming because each farmer produces a larger crop. But if new land yields large crops, more people can live in its cities and that means more farms to feed the people.

Parts of Europe lead the world in yield per acre of several crops (Fig. 72). Belgium produces 38 bushels of wheat per acre, whereas Iowa, one of our best farming states, produces only 18.7 bushels. Potatoes in Belgium

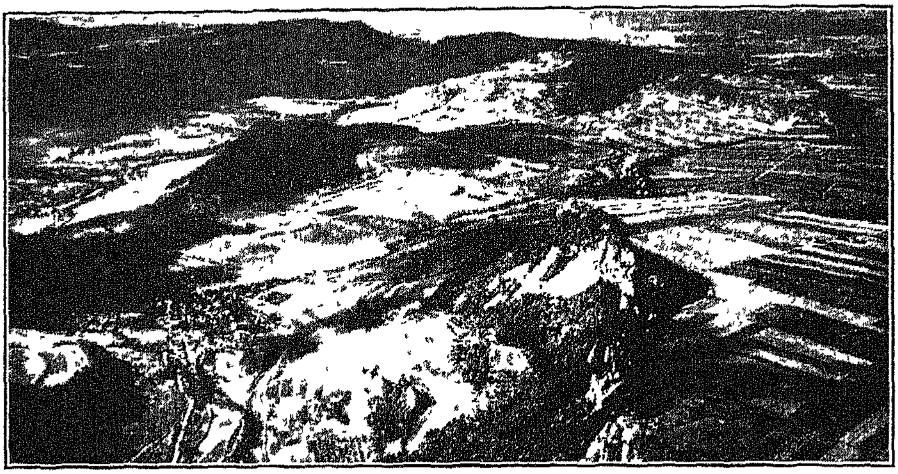


*After Goode, Philip, Atwood and others*

Name six or more farming areas in the Southern Hemisphere Either one of the great than half a dozen of the areas in the Southern Hemisphere

grow 280 bushels to the acre; in Iowa 82 bushels. As expected, Belgium has a population density much greater than that of Iowa, 686 persons per square mile compared with 45 per square mile in Iowa. Yet one-fifth of the people of Belgium are engaged in farming. In England only 7 per cent of the population engage in farming. England must import much food.

Where there is not much manufacturing, the importance of farming is very noticeable Such lands may develop dense populations. Moreover, the way the huge numbers of people have been able to live in such countries for thousands of years indicates how fundamental farming is China has four hundred eighty million people most of whom have been farmers for centuries They are skilful farmers too (p. 141). Each Chinese family has only a few acres of land and this land must produce as much food as possible The farmers of Japan, Java, and India are much like those of China. A land which devotes too much of its effort to farming tends to become backward We learned that China and Japan have no beef animals. Where the population is so dense the land must be used to raise food for the people instead of growing feed for cattle (see Fig 100, p. 134).



Courtesy of Photogrammetrie München

FARM VILLAGES IN SOUTHERN GERMANY

FIG 72 This airplane picture shows the intensive use of the land for crops and hay in a region of dense population In this region the cattle are kept in barns and fed most of the year, when they are pastured they are tethered in the fields or grazed in the mountains The people live in villages and go out to the fields to work Note a second village in the distance In this great manufacturing country the people eat all the food the nation can produce and import much more Nearly every root, vegetable, and cereal crop is represented in the different fields, the animals include cattle, sheep, swine, goats, and chickens

But these people have swine and poultry and eat large quantities of eggs, chicken, and pork

**Population and Types of Farming.** The type of farming also has a close connection with the characteristics of the people Which types are associated with the densest population? Which with sparse population? Two of the types with small populations have a peculiar importance today. More than any others, they have enabled some countries to break away from farming and become industrial and commercial nations

The first of these two to appear was plantation farming in the tropics (Fig. 73) Originally this was carried on with slave labor, which was an indication of the factory-like nature of this kind of farming It is characterized by large areas devoted to a single crop, it requires much manual labor, it requires men and capital from the manufacturing countries. The products are consumed largely in the manufacturing regions of the Northern Hemisphere.

Cereal farming in the semiarid plains differs greatly from the plantation type. Most of it takes place in temperate lands between the areas of grazing and mixed farming. It also is characterized by large areas devoted to a single crop but it uses few workers and much machinery. It did not become a distinct type until machinery of all kinds became common, especially steamships, railroads, windmills, and harvesting machinery.

PLOWING RED CLAY LAND FOR SUGAR CANE

FIG 73 To produce the huge sugar crop of Cuba enormous amounts of capital, many laborers, much machinery, and efficient organization are required Plowing and getting the land ready for cane are difficult and expensive tasks.

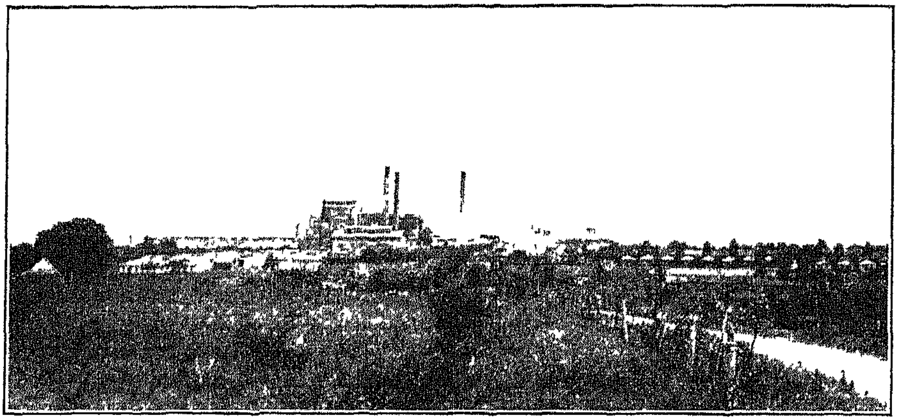
## EXERCISES

1. Study the map, Chief Farming Areas. (*a*) What relation is there between the four great farming regions of the world and plains or mountains? (*b*) Name the plains (*c*) What relation is there between them and forests? (*d*) Grasslands? (*e*) How much rainfall do these four regions receive?

In answering the following questions use the relief, rainfall, temperature, and vegetation maps 2 (*a*) Why doesn't the farming region extend farther north in Canada? (*b*) Farther west in the United States? (*c*) Why is much of Mexico unsuited to farming? 3. (a) What limits the farm region of Europe to the north? (*b*) To the southeast? 4. (*a*) Why is there little farm land in western and central Asia? (*b*) In southeastern Asia what large islands have good farm lands? 5. (*a*) Where are the farm lands of Australia? (*b*) New Zealand? (*c*) Why are there no farm lands in northern Australia and central Australia? 6 (*a*) Where are the chief farm lands of Africa? (*b*) Why does the large lowland area of Africa have few farms? 7 (*a*) Where are the chief farm lands of South America? (*b*) The large lowland area of central South America has no farms. Why? (*c*) Why is there so little farm land in western South America?

8 What relation exists between farming and commerce? 9. What types of farming do we recognize?

10 (*a*) What relation is there between the four great farming regions and population? (*b*) If some farming areas in Japan support three thousand people per square mile (p. 141), how many must each acre support? (*c*) In these places would the farmers have many animals? (*d*) Why? (*e*) How are the types of farming related to the number of people in a region? (*f*) With the maps and the text contrast in outline form the types of farming illustrated by the several pictures in this chapter.



*Central* Hershey, Hershey, Cuba

Fig 74 The refinery shows in the center, on the right are the homes of the laborers who work in the mills, on the left among the trees are the homes of the foreign manager and engineers In the left foreground is pasture for work animals Hershey, Cuba, is a village of nearly 2,000 people all supported by *Central* Hershey which has a yearly capacity of 650,000 bags, of 325 pounds each, of sugar During the grinding season from December 1 to May 1 about 1,300 men are employed in and around the mill, and about 1,000 during the non-grinding season of refining and repairs *Central* Hershey is a large factory requiring much capital, great skill, and efficient management

## CHAPTER XIII

# PLANTATION FARMING IN THE TROPICS

The products of plantation farming in the tropics, like sugar, cacao, and rubber, have a unique place in world commerce. None of the world's leading countries produces much of any of them, but these countries need large quantities of them for foodstuffs and raw materials

## § I — SUGAR CANE FARMING

**A Cane Plantation.** Figure 74 shows *Central* Hershey and Fig. 75 the transportation lines of the Hershey Corporation The figures illustrate the size and equipment necessary in plantation sugar cane farming. How many miles of railways are used? From how much land does the corporation draw cane? How many men are employed in the mill town of *Central*[1] Hershey? On the average it takes ten laborers and twelve oxen to plant, cultivate, and harvest one hundred acres of cane in a year How many laborers would be used in raising and harvesting the cane on ninety thousand acres of land? How many oxen? These do not include the men required in transporting cane to the *central*, in grinding cane, and in repairing equipment To produce this sugar the corporation has a huge factory, hundreds of railway locomotives, cars, plows, carts, oxen, brood cattle,

[1] *Central* is the name given to a sugar plantation and factory.

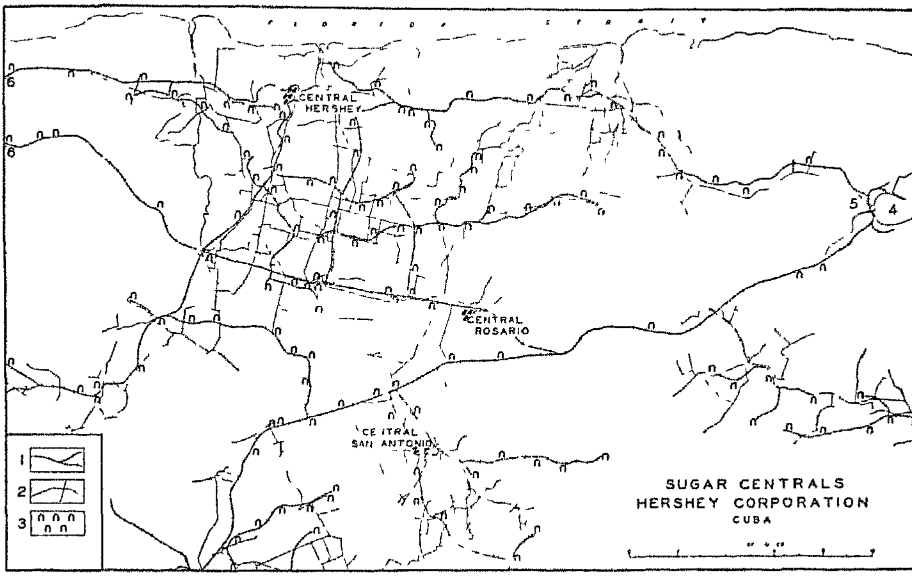



FIG 75 1, The corporation and other railways used to transport cane to the three *centrals* and sugar to Matanzas and Havana for export 2, Cart roads used to haul cane from fields to the cane loading stations 3, Railway cane loading stations 4, Bay and port of Matanzas 5, City of Matanzas 6, Railways to Havana, 12 miles from the outer edge of this area

What three *centrals* does the Hershey Corporation operate? Two hundred twenty-seven miles of railway lines supply the *centrals* with cane, including the sidings at the cane loading stations How many cane loading stations are required? *Central* Hershey is the largest, it alone has 165 miles of railway lines serving it

The corporation grinds sugar from its plantations of sixty thousand acres and from about thirty thousand acres under lease The fertile valleys of red clay soil are the best cane lands The areas on this map where there are no cane railways or roads shown consist of wooded hills, waste land, pasture or food crops In the southern part of the area two other *centrals*, not belonging to the corporation, have cane lands Most of the corporation cane in the southern part of the map goes to *Central* San Antonio, and that in the southeastern to *Central* Rosario, but some from the southern edge of the area goes to *Central* Hershey How far does this cane move by rail? It is not profitable to haul the heavy cane by bullock cart for more than five miles. On each cart four or six oxen are used.

riding horses, and mules. This requires a huge, efficient organization The man who manages the corporation has had years of experience and is more like the manager of a great factory than that of a farm. Sugar cane plantations have modern machinery and efficient management. They need modern methods to obtain a large yield of sugar from the cane.

**Cuba's "Centrals" and Sugar Crop.** Figure 76 shows that Cuba has many *centrals* located in many parts of the island Sugar dominates most activities in Cuba. Sugar is the leading export, it gives Cuba an important place in the commercial world. The position of Cuba in the sugar business depends upon a number of advantages in producing and marketing the product.

**Area Suited to Sugar.** With respect to land suited to sugar cultivation on tropical islands, Cuba stands alone. Most areas, like Hawaii, Java, and Puerto Rico, have mountains not

favorable for crops. Allowing for mountain areas, swamps, and infertile soils, it is estimated that half of Cuba is suited for the cultivation of sugar

**Small Population a Disadvantage and an Advantage.** Compared to other sugar producers, Cuba has a small population It has 4,000,000, Java, 40,000,000, British India, 353,000,000 Expressed in another way, Cuba has 65 people for every square mile, Java, 671, and British India, 194 The sparse population of Cuba does not supply sufficient labor for harvesting the crop, so that many laborers are brought in from the West Indies But the small population gives more land for sugar and a large part of the crop for export. For example, British India, the leading cane sugar producer, exports no sugar, in fact it imports some for its millions of people.

**Preparing the Land for Cane.** On new lands the vegetation is cut down and burned. The stumps are taken out and the land plowed. If the land has been cutivated it is burned over, and then with tractors or oxen is plowed, harrowed, and laid out in furrows about six feet apart (p. 105). Pieces of mature cane stalks are planted in the furrows about three feet apart. In no area can the land be prepared and cane planted so cheaply as in Cuba. Cane is planted at different times. Canes planted from February to March are harvested eleven or twelve months later, those planted in April and May are harvested in February, those planted in September are harvested about eighteen months later. In general the canes planted in September give the greatest yields Can you explain why? The three plantings make use of the labor over a long period and thus save money

**Several Crops from One Planting.** If growing conditions are favorable, sugar cane does not require planting every year. After a crop is cut new shoots grow from the root stalk; second or third crops are known as "ratoons" Cuban soils are fertile and yield from four to six ratoons from one planting After such a period the land may be pastured for several years when it can be replanted with cane. In Cuba the climate and soils are so favorable that lands go through a number of these periods of production and rest and still produce good cane. Not many countries have this big advantage. Puerto Rico gets only one ratoon, Hawaii harvests two ratoons, Peru cuts five. Why is a ratoon crop much less expensive than a plant crop?

**High Temperatures.** One reason


FIG 76 List all the points this map tells you about the advantages of Cuba for producing sugar

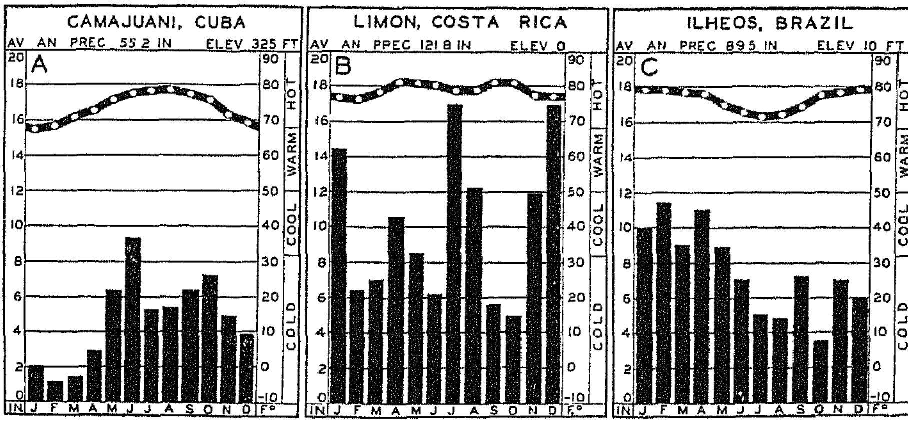



FIG 77 Chart A shows temperatures and rainfall favorable for sugar culture, B for banana, and C for cacao Explain why cane in Cuba makes its rapid growth from March to December Low temperatures and light rainfall from January to March cause the cane to store up sugar This dry and somewhat cooler season in Cuba favors sugar culture in what other ways? How much precipitation do these three stations get a year?

Why does the temperature curve for Cuba bend upward in April to June while that for Ilheos bends downward? How long is the growing season in Cuba? In Changsha, China (page 136)? In Prince Albert (page 181)?

why Cuba gets several ratoons is because of high temperatures all of the time (Fig. 77). It takes ten to eighteen months for cane to mature with the highest sugar content. In Louisiana and Argentina, because of frosts, cane must be cut sometimes before it is ripe But in Cuba no producer is bothered with frosts. From December to May the temperatures are lower than during the rainy season What other advantages does this give the sugar producer? While the cane is small all weeds are cut down with hoes or machetes several times because they grow rapidly in hot rainy regions (Fig 78)

**Adequate Rainfall.** Most of Cuba has an annual rainfall of more than forty-five inches Abundant rains occur from April to November when the growing cane needs much moisture, and some rain falls in other months In other sugar areas, like the southern coasts of the Hawaiian Islands, southern Puerto Rico, parts of India, and coastal Peru, the lands are too dry for cane so that the crop must be irrigated, only high yields of good cane per acre will pay for irrigation

**The Dry Season and Harvest.** During the rainy season cane grows stalks and leaves and does not store up much sugar After several months cane, influenced by dry and cooler weather, ripens and has the highest sugar content. The sucrose content increases from about 9 per cent in December, at the beginning of the grinding season, to 15 per cent near the end of the grinding season in March and April Spring rains in April cause the cane to turn green, start growing rapidly, and the sucrose content to drop to 9 per cent or less Therefore, Cuban cane is cut and ground from December to May when the sugar content is highest. Also, cane doesn't sour or spoil so soon during dry months At this time of year work is somewhat more comfortable owing to

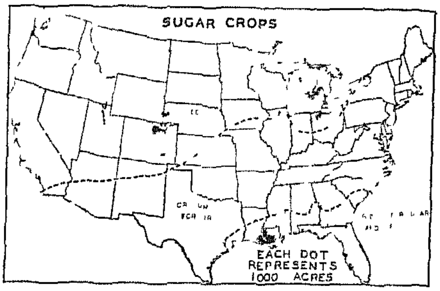
slightly lower temperatures and strong trade winds. Also, since the ground is dry, it is possible to haul the heavy cane in huge oxcarts to the loading stations For these reasons most cane is grown in regions with a wet and dry season rather than in places with much rain every month

**The Shape and Coast Line of Cuba.** Because of the shape of Cuba no place in the island is more than sixty miles from the sea The *central* must be located near the cane fields because cane will spoil if it isn't ground within a few days after being cut, the cost of hauling the bulky cane a long distance would be too great. Therefore, in Cuba the *centrals* are near the cane and also near the sea, many *centrals* load sugar directly on board an ocean vessel. Also, Cuba has more than twenty excellent pouch-shaped harbors that serve the many ships coming for sugar.

HOEING CANE IN CUBA

FIG 78 This level fertile land is fine for cane farming, but hoeing the cane in the red clay soil is hot, hard work and requires many laborers

**Nearness to the United States and Preferential Treatment.** In addition to the previously mentioned eight advantages for sugar culture, Cuba lies near the United States, the largest single sugar market, consuming about one-fourth of all the sugar produced in the world. This large supply comes from three sources. one-half from




*Courtesy of United States Department of Agriculture*

CANE AND BEET SUGAR IN THE UNITED STATES

FIG 79 What effect on the cane area of Louisiana does tariff protection have?

Cuba, one-fourth from Puerto Rico, Hawaii, and the Philippines, and one-fourth from sugar cane in Louisiana and sugar beet districts (Fig 79). Cheap production methods and water transportation favor Cuba Sugar from Puerto Rico and Hawaii comes into New York and San Francisco duty-free Cuban sugar pays a tariff, but the duty is only four-fifths that levied on other foreign sugar This gives Cuban sugar an advantage.

**Other Sugar Areas.** Sugar cane is grown for local use in most sections of the tropics. The sugar produced, however, is a crude brown product made by small local mills Commercial sugar production is concentrated in a few areas In the Caribbean region sugar is produced chiefly in the West Indies; in South America on the east coast of Brazil, in Argentina, and in coastal Peru (Fig. 80). Africa, lying largely in the tropics, produces little sugar. Northeast Australia has a small sugar area Southeastern Asia produces much sugar, the Philippines, Formosa, Java, and British India being especially important.

**India.** India produces as much sugar as Cuba but its crop hardly suf-

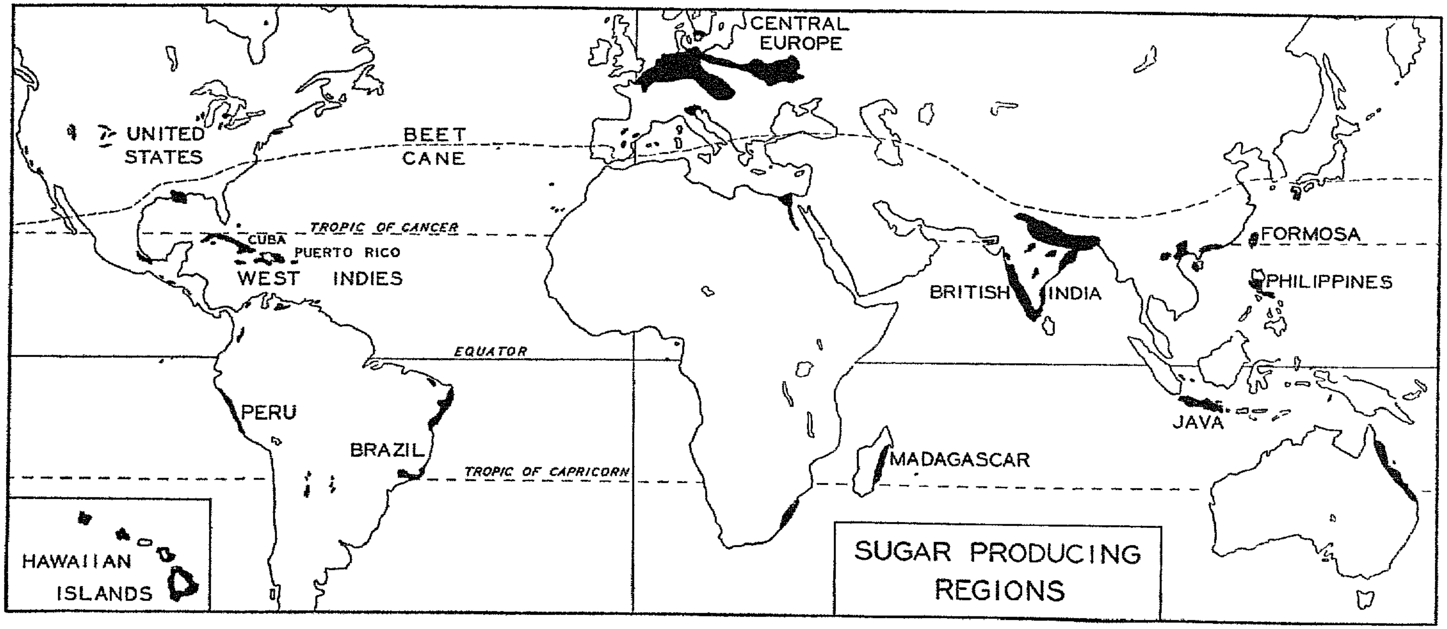



FIG. 80 From this map of the chief sugar producing regions of the world, tell why the great cane producers lie between the tropics Sugar cane is distinctly limited to hot climates and the beet to cool ones Note that sugar cane does grow in the temperate zone in Louisiana, Egypt, Japan, Argentina and southern Africa, but sugar cane does best in areas free from frost and where the temperature is from 68° F to 80° F throughout the year Sugar beets grow best where the mean summer temperature is between 67° F and 72° F, it requires a sandy loam soil and cheap labor Most of the beet districts are protected by a tariff on the imports of sugar What percentage of the world's beet sugar do the countries of Central Europe produce (table, page 113)?

fices for its own population India has no large *centrals* like those of Cuba The sugar produced is a soft brownish sort called "gur" In the hot rainy plains of the Ganges cane is grown on every farm In the west irrigation is necessary While India uses about the same amount of sugar as the United States, each person in the United States uses more than three times as much sugar as each person in India. In the United States each person uses on the average one hundred pounds of sugar every year. The Chinese use only five pounds per person per year

**The Javanese Sugar Industry.** Java is not located so advantageously as Cuba with regard to markets but it has an efficient industry The people make so much money growing sugar that the government enforces strict rules to keep them from planting too much cane In a land having only fifty thousand square miles and forty million people, food crops must have first choice of the land Nevertheless, Java produces much sugar each year It has modern methods of cultivation, crop rotation is systematically practiced to conserve soil fertility, more than 90 per cent of the plantations are irrigated The growers depend upon a high yield to pay costs (Fig 81). These methods would not prove profitable in Cuba, where many acres are farmed more cheaply to give the big crop.

**World Trade in Cane Sugar.** The four most densely populated areas of the world are the sugar importers. The United States and Canada buy chiefly from the West Indies, Hawaii, and the Philippines. The United States takes 40 per cent of the world's imports Northwest Europe buys chiefly from the East and West Indies and Peru. Japan buys from Formosa and other islands China and India buy from Java, the Philippines, Mauritius, and other islands The chief cane sugar exporters are Cuba, Java, Hawaii, and the Philippines, many other islands also export sugar.

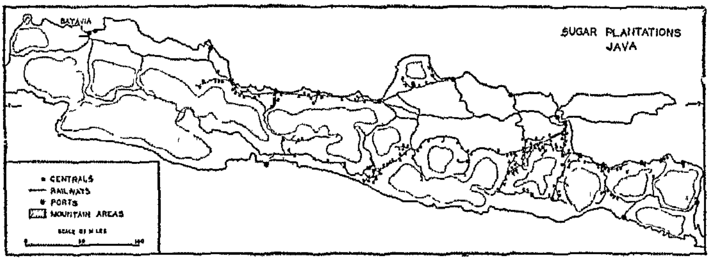



FIG 81 Which has more mountains, Java or Cuba? Are the mountains of Java of any value to the sugar grower?

## EXERCISES

1. (*a*) What percentage of the world's sugar is cane sugar? (*b*) What percentage of the world's cane sugar does Cuba produce?

2. List ten advantages Cuba has for the production and the exportation of sugar.

3 (*a*) How do methods in British India differ from those in Cuba? (*b*) In Java?

4. (*a*) What are the chief sugar importing regions? (*b*) Why?

5. (*a*) From what areas does each major region get its sugar? (*b*) List

the conditions that the chief sugar exporting islands have in common (*c*) Brazil doesn't export any sugar Can you explain why?

6 List the bases for a large sugar trade between the United States and Cuba

THE WORLD'S SUGAR CROP (Three year average)

| *Raw Beet Sugar* | | *Raw Cane Sugar* | |
|---|---|---|---|
| *Country* | *Short Tons* | *Country* | *Short Tons* |
| World Total | 10,740,000 | World Total | 19,720,000 |
| Germany | 2,240,000 | Cuba | 3,910,000 |
| Soviet Russia | 1,490,000 | India | 3,680,000 |
| United States | 1,200,000 | Java | 3,020,000 |
| Czechoslovakia | 1,090,000 | Brazil | 1,080,000 |
| France | 1,090,000 | Philippines | 980,000 |
| Poland | 800,000 | Hawaii | 960,000 |
| Italy | 460,000 | Formosa | 940,000 |
| United Kingdom | 410,000 | Puerto Rico | 860,000 |
| Spain | 290,000 | Australia | 620,000 |
| Belgium | 270,000 | Peru | 480,000 |
| Netherlands | 260,000 | Dominican Republic | 410,000 |
| Hungary | 220,000 | Argentina | 390,000 |
| Sweden | 160,000 | United States | 180,000 |

## AN EXTRA LESSON

"Sugar Production in the United States" — B, XXVII (1928), 287–300, A, III (1927), 61–62, 486–506, 24, pp. 465–468, 477–482; 2, I, pp. 75–88

For an extra lesson on references on "Sugar Refining in the United States," turn to p 379.

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"Sugar in World Trade" — 12, pp. 102–107; 90.

"A Sugar District in Cuba" — J, XIX (1929), 603–612.

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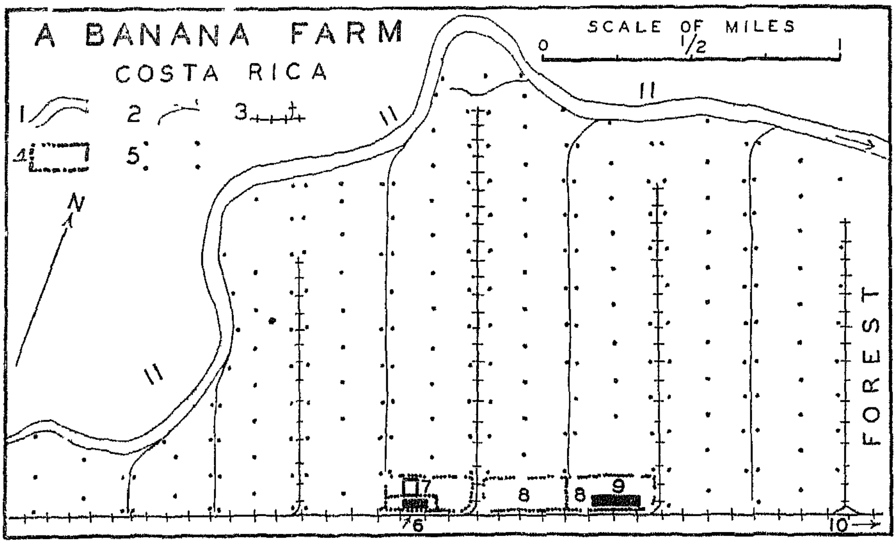
[2] Numbers and letters refer to Selected References on pages 420–424




A TYPICAL BANANA FARM IN COSTA RICA

FIG 82 1, Stream 2, Master drainage ditches 3, Railway lines 4, Fences 5, Unfenced fields 6, Farm manager's home 7, Riding horse corral 8, Pastures for mules and draft cattle 9, Homes of laborers 10, Twenty-two miles by rail to Limon 11, Another banana farm across the river What are the chief differences between the layout of a sugar plantation and a banana farm? Locate the farm on Fig 83

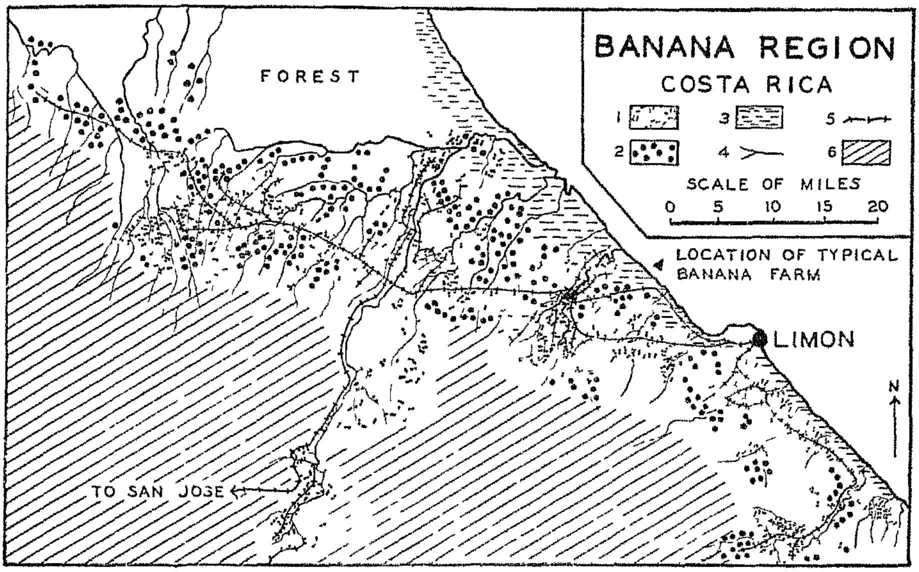
## § II — PLANTATION BANANA FARMING

The bunch of bananas at your grocer's represents achievements even greater than those of the neatly boxed sugar. Bringing the luscious fruit to your table involves so many difficulties that one wonders that anyone ever tried to develop such an industry

Bananas appeal to us because of their delicious flavor. This has been the main reason for the growth of the banana industry. But if we were to visit the home of a laborer on a banana plantation, we should find another recommendation for bananas. The banana is one of the principal items of his diet, chiefly because it furnishes carbohydrates and small amounts of protein and fat, its food value closely resembles that of potatoes. The natives eat bananas in a variety of ways, fresh, baked, boiled, fried, candied, or as flour

**A Banana Farm.** Figure 82 shows a banana farm The farm, on level sandy loam plains in one of the best banana regions of the Caribbean, contains about two thousand acres It is divided into banana fields of about twenty-five acres each All the land is in bananas, except that occupied by buildings, pastures, and roads The farm has a manager and nearly two hundred laborers, it has about five miles of branch railway lines and a main line which goes direct to the ocean port only twenty-two miles away Many great farms are in this fine banana region.

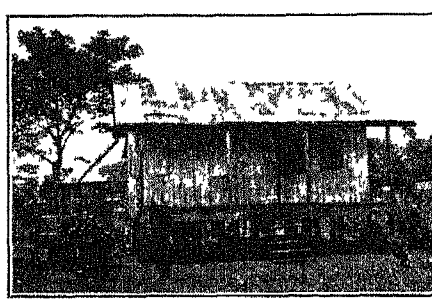
**The Banana Plant and Plantation Areas.** The nature of the plant limits




A Fine Banana Region in the Caribbean

Fig 83 1, United Fruit Company banana farms 2, Other banana farms 3, Coastal swamps 4, Streams. 5, Railroads 6, Forested mountains This map shows especially well some of the conditions necessary for commercial banana production

its cultivation to humid tropical lowlands (Fig. 83). In twelve months it grows to full size and matures fruit. It reaches a height of twenty feet and at the base a diameter of fourteen inches. It blossoms and matures fruit every month in the year. Near the top of the weak fleshy stem a bunch of fruit weighs from fifty to one hundred pounds Conditions for banana cultivation are high temperatures and intense sunlight all the year, a rainfall of more than seventy inches well distributed throughout the year, a well-drained sandy loam soil, and freedom from wind storms (p. 109, Chart B) All of these conditions can be found only in rainy lowlands in the tropics. The heaviest and best developed bunches reaching the United States come from Panama, less than ten degrees from the Equator, and the smallest from Mexico near the northern margin of the tropics Consequently, the plantations are located where bananas grow best. in the hot, rainy lowlands near the sea, whence they can be moved quickly to the consuming areas.



Home of Banana Laborer

Fig 84 The house, built on poles to avoid moisture and crawling animals, is made of boards and covered with sheet iron The rains that fall on the roof are drained into the covered wooden tank at the left; this is the water supply of the family

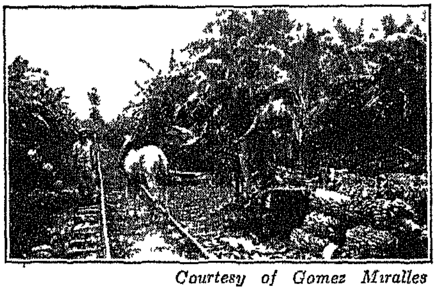
CUTTING A BUNCH OF BANANAS

FIG 85 As the cutter on the left cuts the banana stalk near the top with the knife on the long pole in his right hand, the top of the stalk bends over, then he cuts the leaves and the banana stem with the machete in his left hand The packer takes the bunch as the stem is cut and he carries it to a cart or mule The cutter cuts the stalk down and leaves it between the rows to rot

**Commercial Banana Production.** To establish the large banana industry in the Caribbean, men had to solve great problems of labor, transportation, disease, vegetation, climate, and soil.

In Central America where bananas are now produced, few people lived because of heat, rain, diseases, and forests. Many laborers were brought from the West Indies to start plantations. Before bananas are planted, railways are built and homes constructed To make the area livable for man, companies drain large areas and build wooden houses off the ground on concrete pillars or on poles Doors and windows are screened Tanks catching rain water for drinking purposes are protected from malaria mosquitoes (Fig 84) The plantations have hospitals, doctors, and nurses to treat tropical diseases, they also have schools Plantation stores sell food and clothes brought in by the fruit company

The first step in making a banana plantation consists of clearing the dense tropical forest This is a difficult task because of the heavy growth of big trees, small trees, shrubs and vines, and hot rainy weather After the trees are cut and burned, young banana shoots are planted in rows between the old stumps The plants grow rapidly, but so do weeds and sprouts, which are chopped out with a hoe every few weeks One plant produces in twelve months one bunch of bananas and then is cut down and piled between the rows to rot with the cut weeds for fertilizer (Fig 85) The root stock sends up "suckers" which grow into large plants Laborers cut some of the suckers, but allow a few to grow from each root stalk. By having suckers of different



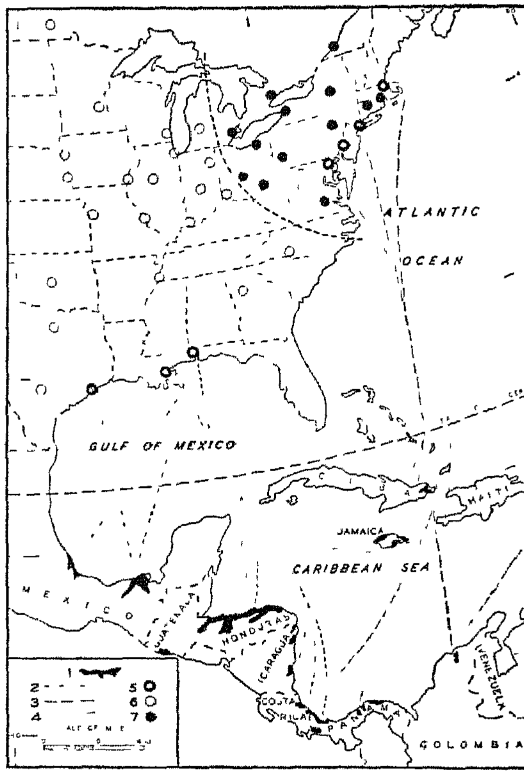
*Courtesy of Gomez Miralles*

BRINGING BANANAS TO THE RAILWAY

FIG 86 The bananas on each farm are brought out to the main railway line on the backs of mules or on small carts Thence they are moved rapidly to the ship

ages, bananas are harvested every week in the year.

Bananas are cut green and moved to the refrigerated ships in a few hours to keep them from ripening too soon (Fig 86). On the ship they are cooled quickly to about 57 degrees Fahrenheit. Engineers inspect them frequently to keep them from ripening before they reach the market. To bring bananas to distant markets, companies have developed complicated organizations covering every branch of the industry from plantations to fruit stores One large company controls about half of the production It has plantations in all chief producing areas. It employs about seventy thousand people, many thousands of them in the banana regions, has almost one hundred sea-going vessels, fifteen hundred miles of railway and seven hundred miles of tramway, an elaborate system of radio, telegraph, and telephone lines, sugar mills and refineries, ice plants, electric light plants, laundries, hospitals, water works, and sewerage systems.




THE CARIBBEAN BANANA REGION AND TRADE

FIG 87 1, Banana plantation areas 2, Routes to Gulf ports 3, Routes to Atlantic ports 4, Routes to Europe 5, Banana importing points 6, Interior distributing points 7, Eastern distributing points

Even this does not tell the whole story Although in native banana production a banana patch may yield fruit for twenty or more years, the banana is known as a "soil-killing" plant On many plantations the yield of fruit becomes so small after ten years from the time the land is cleared that the banana plants are removed and a different crop planted. This has meant great expense in finding new crops to make the land useful until bananas may be planted again on that area. The great banana company now has ninety thousand acres of sugar cane, fifty thousand acres of cacao, and nine thousand acres of coconuts, alternating with the banana plantings.

**The Banana Industry of the Caribbean Region.** Although the banana is widely used as a food in the tropics, the banana trade is only about fifty years old (Fig. 87) As late as 1870 few people in the United States had seen a banana. The Caribbean region lies near us and its physical conditions enable it to send huge quanti-

ties of bananas to the United States and to Europe It now ships nine-tenths of the world's commercial output of bananas, or more than ninety million bunches a year What countries produce bananas commercially? Two-thirds of the output come from Honduras, Jamaica, and Colombia

Two-thirds of the ninety million bunches exported each year go to the United States Most of the American imports come from Honduras, Jamaica, and Guatemala The United Kingdom is second to the United States in banana consumption, but the total is only one-fifth as great as ours One-third of the United Kingdom imports originates in Colombia. Would you expect a country like Czechoslovakia or Hungary to import many bananas? The Hawaiian Islands and the western coast of Central America ship some bananas to western United States, the Canary Islands ship to Europe

## EXERCISES

1 (*a*) Why do bananas appeal to us? (*b*) Contrast a banana farm and a sugar plantation

2 List the habits of the banana which require heat, sunshine, rain, sandy soil, and freedom from winds

3. List seven or more factors that favor banana culture in the banana region of Costa Rica

4 (*a*) What special problems do banana companies have to solve? (*b*) Describe the cultivation of bananas (*c*) Why does one company have plantations in all the producing areas?

5. (*a*) What countries produce most of the bananas? (*b*) From what countries do we buy most of our imports of bananas?

6.

OUR BANANA IMPORTS
(A recent year)

| *Imported from* | *Bunches* | *Imported from* | *Bunches* |
|---|---|---|---|
| British Honduras | 142,000 | Honduras | 22,064,000 |
| Colombia | 1,534,000 | Jamaica | 16,440,000 |
| Costa Rica | 4,384,000 | Mexico | 6,505,000 |
| Cuba | 2,020,000 | Nicaragua | 2,682,000 |
| Guatemala | 4,874,000 | Panama | 4,678,000 |
| Total United States | | 65,334,000 | |

(*a*) What part of the world output do we buy? (*b*) Can you explain why?

7. Name the Gulf and Atlantic ports (p. 117).

8 Explain how bananas move from Costa Rica to a small town in southern Wisconsin

9. What are the chief distributing centers of Michigan?

10 List the geographic bases of the banana trade between the Caribbean region and the United States.

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[3] Numbers and letters refer to Selected References on pages 420–424

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## § III — CACAO

In contrast to sugar, cacao was unknown in Europe until America was discovered Cortez learned of cacao in Mexico and sent the king of Spain a package of cacao beans as a present. Spain imported and distributed cacao to Europe, but its use spread slowly Now cacao production is a large plantation industry and cocoa and chocolate are widely used, especially in the United States and Europe Chocolate is one of the finest foods It packs so much energy into a small amount, tastes so good, and keeps so well that it is a favorite food of explorers who run the risk of not finding good food in the lands through which they travel.

**Requirements of the Cacao Tree.** A cacao plantation in Ecuador shows the requirements of the cacao tree. The plantation is located on the lower slopes and floor of the valleys north of Guayaquil. The rich, deep, alluvial soil is moist and well drained. The estate has more than eighty inches of rain per year and there is no real dry season. A less rainy season favors harvesting and drying the beans. Fogs and mists drift up the valleys and keep the air very moist. Tall shade trees protect the cacao trees from the strong sunshine and keep the air humid The air is always hot and there is little wind Winds would cause the pods to drop from the trees or to dry up and produce poor beans. The estates are near rivers that carry the beans to the ocean vessel at Guayaquil However, the dried beans do not require rapid transportation like bananas.

**How Cacao Is Gathered and Prepared.** Few of the millions of people who relish cocoa or chocolate would recognize the cacao bean or the pod in which it grows The pod looks like a large fat cucumber hanging from the trunk or limbs of the tree. Each

pod contains a number of beans imbedded in a slimy sweetish pulp This manner of growth means that much hand labor is needed for harvesting.

HULLING CACAO BEANS, PANAMA

FIG 88 The man on the right cuts open the pod in his left hand with a machete and drops it by the box, a Negro woman scrapes the beans and pulp out of the pod and drops the beans into the box Locate Panama on the cacao map

The laborers with a machete cut off the pods one by one Men then cut open the pods. Often Negro women remove the beans from the pod (Fig. 88) The beans are piled in bins and allowed to "sweat" or ferment for four to six days, being turned by hand each day. The fermentation loosens the pulp, destroys the bitter taste, develops the flavor, and dries the beans. The beans are further dried either on open trays in the sun or in large kiln dryers (Fig 89) The quality of the cacao depends largely on the skill and care in preparing and curing the beans. When the beans are dry, they are sacked and sent to factories in the United States and Europe The best cacao comes from the West Indies, islands that have prepared cacao for a long time.

**Cacao Producing Regions.** Nearly all the world's supply of cacao comes from four regions western Africa, eastern Brazil, Caribbean America, and Ecuador (Fig 90) In western Africa the coastal lowlands from Sierra Leone to the Equator produce more than half the total

**Brazil.** The hot steamy lowlands of the Amazon gave Brazil an early start in cacao production But there are few people here and poor transportation Late in the nineteenth century cacao was introduced into eastern Brazil, which has become the leading area in South America. The relief, soils, rainfall, temperatures, lack of winds, and location near the sea are favorable for the cacao tree (p 109, Chart C) This district, a strip three hundred fifty miles long,

DRYING CACAO, COSTA RICA

FIG 89 The tray with the drying beans can be pushed under the little roof at night or during showers Cacao trees touch the Negro hut on three sides

has a large population. A few railroads and rivers carry the cacao to several ports where small vessels pick it up and take it to Bahia, the chief export point.

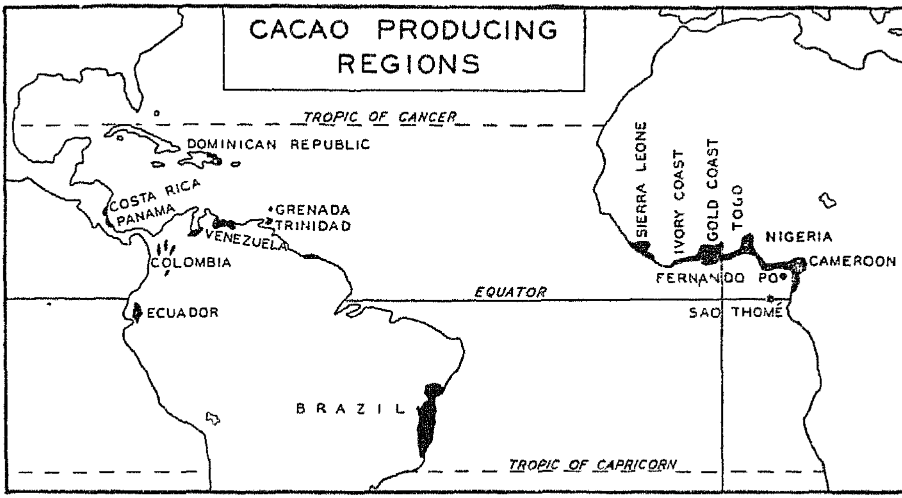
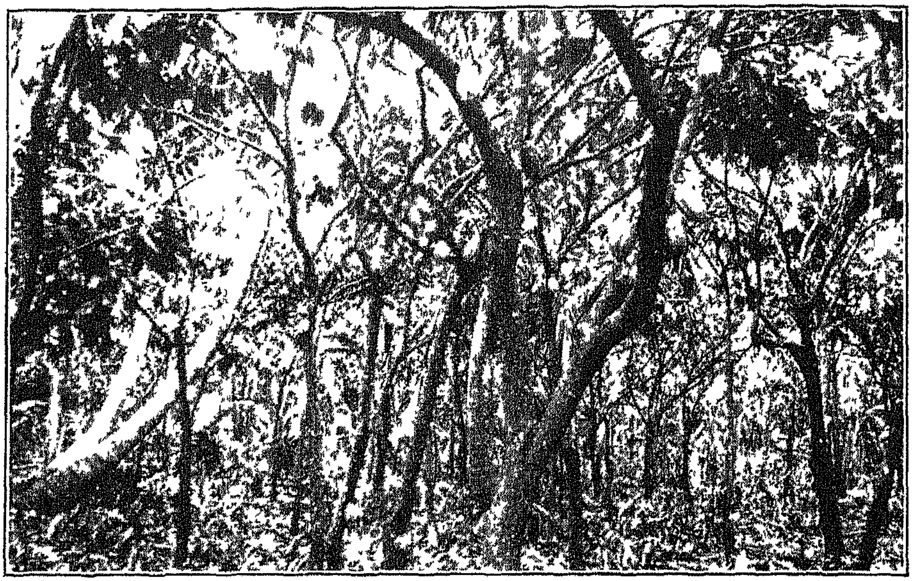



FIG 90 Most of the large cacao regions are within fifteen degrees of the Equator Are the plantations near the sea? Why?

The methods of farming and harvesting cacao are rather crude In the forests natives make partial clearings and plant the trees among tall trees that serve for shade They build poor huts and raise a patch of corn, beans, and bananas for food and sell the cacao beans. Large planters in a region developed in the way just described buy up these small cacao areas until they have an area large enough for a plantation This is a cheap way for them to get a plantation for they don't have the expense of clearing and starting the trees The natives don't prepare the beans very well so that the quality is not the highest. The state of Bahia further reduces the profits to the grower by putting a heavy export tax on cacao

**Ecuador.** The cacao district of Ecuador lies in the alluvial lowlands north of Guayaquil It has a width of from twenty to ninety miles and a length of two hundred eighty miles Several rivers drain the lowlands and provide transportation The physical conditions for cacao here seem almost ideal At one time Ecuador dominated the world's output and market of cacao, contributing one-third of the total thirty years ago The natives know how to prepare the beans so that Ecuadorean cacao is of excellent quality.

Several years ago two diseases attacked the cacao and have spread to all the plantations in Ecuador As a result the cacao production of that country is less than it was forty years ago. The diseases are difficult to get rid of for several reasons The hot humid climate that is ideal for cacao is just right for the diseases Shade trees are too large and do not let the sun dry the trees The natives do not clean the trees well In short, they do not know how to fight the diseases. With competition from other regions and no scientific fight against these diseases, Ecuador is in danger of losing its great cacao industry. This often happens in the tropics



IN A CACAO GROVE, GRENADA

FIG 91 It is very hot and moist in the cacao plantations. Note the cacao pods on the trunk and branches Locate Grenada on the map.

where there is so much idle land suited to a crop.

**Caribbean Region.** In the Caribbean region several areas produce cacao (p. 121). The plantations are located either on the lower slopes of deep valleys or on the broad alluvial plains. Here are excellent conditions: fertile soils, good drainage, a rainfall of more than seventy-five inches, high temperatures all the time, a less rainy season favoring harvesting and curing, humid air with clouds and mists and rains every day, and protection from winds (Fig. 91) All farms are near the sea and each place has abundant cheap but excellent Negro laborers who prepare the cacao very well. West Indian cacao is the best grade. In most places the cacao is grown on huge plantations managed by white people, but in the Dominican Republic and Haiti the Negroes have small farms of a few acres. In Central America the large banana company also grows cacao In many sections the trees get excellent care. The Negroes cut out the weeds, prune and fertilize the trees annually, and remove the moss and orchids twice a year. With such care some trees yield three pounds of dry cacao beans, whereas by the old method only one pound could be obtained How does the location of this region favor the industry?

**Western Africa.** Thirty years ago this region produced very little cacao. The introduction of cacao changed the life of the natives, lowered the price of cacao in world markets, and caused growers elsewhere to improve methods of culture. The cacao region is a forested lowland within seven degrees of the Equator The region has seven excellent physical conditions for cacao Name them. Growing conditions are so favorable that trees

thirty years of age still bear good crops with little care. Three-fourths of the crop is gathered from October to February. Do the seasonal rainfall maps tell you why this is a good time to harvest the cacao?

In contrast to other areas, cacao in western Africa is grown by natives on small farms through the forest. Foreigners taught them how to plant the trees, care for them, harvest the crop, and prepare the beans. They do not produce as good cacao as the people of the Americas. To aid the natives in producing cacao governments built modern roads for trucks in some sections and railways from ocean ports into cacao districts. The rivers are not navigable and the natives do not keep horses or cattle. The natives carry the beans on their heads from the farms to the villages where they are dried.

**Trade in Cacao Beans.** The chief importing regions are the United States and northwest Europe. New York, Philadelphia, and Boston are the principal ports in the United States, Hamburg, Havre, and London, in Europe. The United States takes about two-fifths of the world's exports.

**Manufacture of Cocoa and Chocolate.** At the importing points the cacao beans are cleaned, ground, and roasted and the fat is extracted. These processes require skilled labor and expensive machinery and are carried on in regions of dense population. The cocoa "butter" or fat is used to manufacture cocoa and chocolate products by many companies in regions of much labor and regions where sugar, milk, and other ingredients can be obtained quickly and cheaply. Why does Switzerland make a great deal of chocolate candy?

## EXERCISES

1. (*a*) Compare the requirements of the cacao tree with those of the banana. (*b*) Contrast the methods of harvesting cacao and bananas. (*c*) Of shipment.

2. CACAO PRODUCTION
(A recent year)

| *Country* | *Pounds* | *Country* | *Pounds* |
|---|---|---|---|
| World Total | 1,160,000,000 | Caribbean Region | 212,900,000 |
| | | Venezuela | 46,460,000 |
| Africa | 739,200,000 | Dominican Republic | 45,540,000 |
| Gold Coast | 485,350,000 | Trinidad | 43,960,000 |
| Nigeria | 110,470,000 | Costa Rica | 16,100,000 |
| Ivory Coast | 44,750,000 | Colombia | 12,290,000 |
| Cameroon | 29,760,000 | Grenada | 9,480,000 |
| Togo | 26,950,000 | Panama | 6,170,000 |
| São Thome | 21,220,000 | Eastern Brazil | 147,100,000 |
| Fernando Po | 19,430,000 | Ecuador | 44,180,000 |
| Sierra Leone | 260,000 | Asia | 13,950,000 |
| | | Ceylon | 8,630,000 |
| | | Philippines | 2,680,000 |
| | | Dutch East Indies | 2,640,000 |

(a) Name the four chief cacao producing regions (b) From the map list the districts of Caribbean America (c) Why are the people of Ecuador unable to cope with the two diseases of cacao? (d) Why is the cacao from the West Indies considered the best?

3 (a) Make a detailed list of the requirements for cacao culture (b) How does the industry in the West Indies differ from that in Africa? (c) List the seven physical conditions favoring cacao culture in western Africa

4 (a) Where is cacao manufactured? (b) Why?

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"Cacao in West Africa" — B, XXXII (1933), 279–284, 105, No 68
"Cacao in South America" — 17, pp 464–466, 518–522, 621–622, 638, 690–692
"Cacao in Trinidad" — A, III (1927), 239–258
"Cacao" — 5, pp 87–102, 96, pp 73–79, 12, pp 74–84

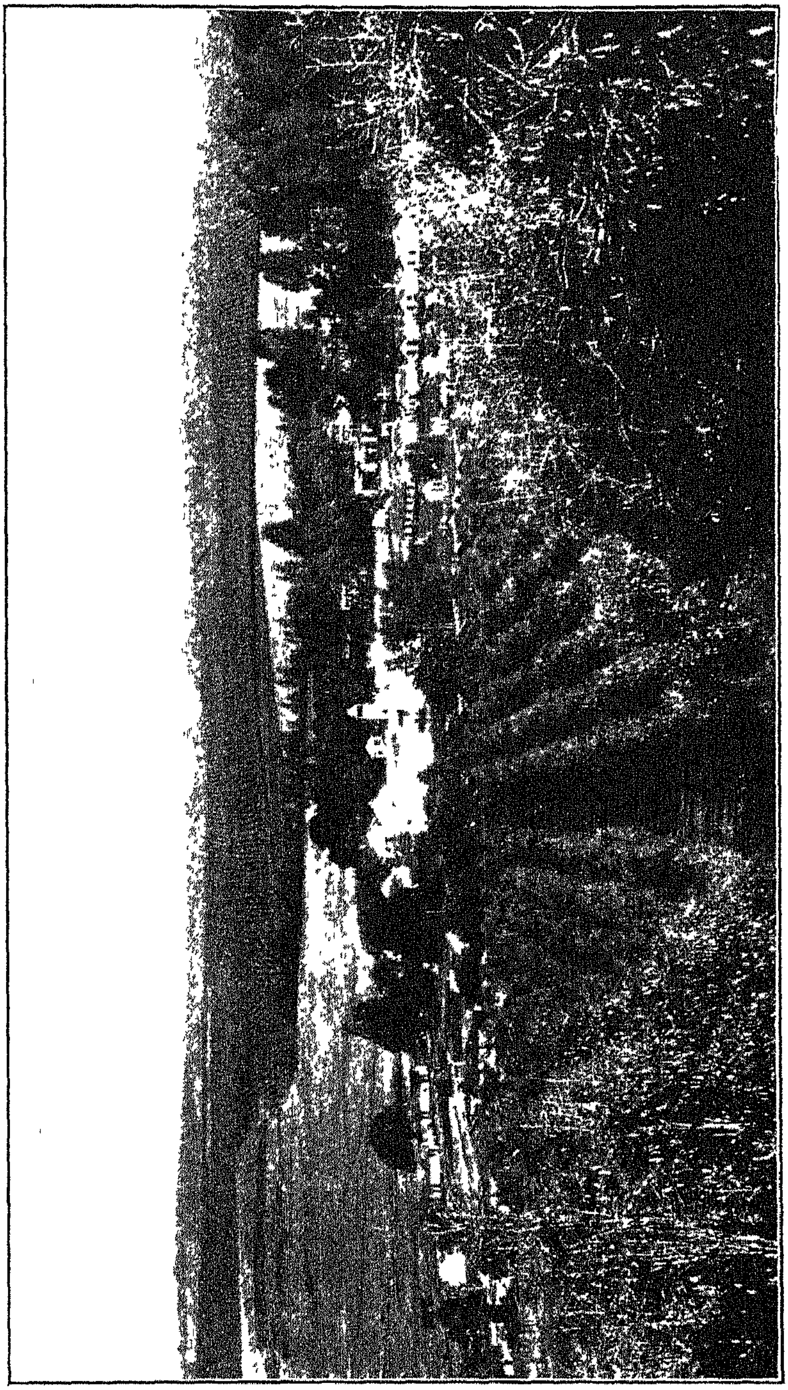
## § IV — COFFEE

**A Coffee "Fazenda."** Figure 92 shows a large *fazenda* or coffee plantation in eastern Brazil In the foreground are rows of coffee trees Just beyond is a row of small homes for laborers. In the center are the big white coffee sheds, drying floors, and sheds for mules, work cattle, and machinery. The sheds contain machinery for hulling, sorting, and grading coffee, wagons for transporting it, cultivators, hoes, and other tools. The *fazenda* owner's home, a beautiful mansion, stands among the trees On the low flat ground are pastures for the work animals and on the hills beyond, as far as the eye can see, extend long rows of coffee trees The plantation covers fifty thousand acres, it has eighteen different villages, all the people working with coffee It has schools, churches, hospitals, stores, and bakeries Private railways connect the plantation with the main line seven miles away. This *fazenda* is near many others like it

Years ago this plantation was established in the forest, the owner laid out the *fazenda* and built houses for the laborers He invited many Italian immigrants to settle on the *fazenda* He gave each family several acres of land to clear and plant to coffee They raised corn, beans, and cassava between the young coffee trees, they kept chickens and pigs and thus made a good living In five years the bearing coffee trees were turned over to the land owner and the family would start all over again on a new piece of land. This system was profitable to both land owner and laborer. The area of bearing coffee trees extended very rapidly, and at little expense to the land owner Coffee trees bear for many years

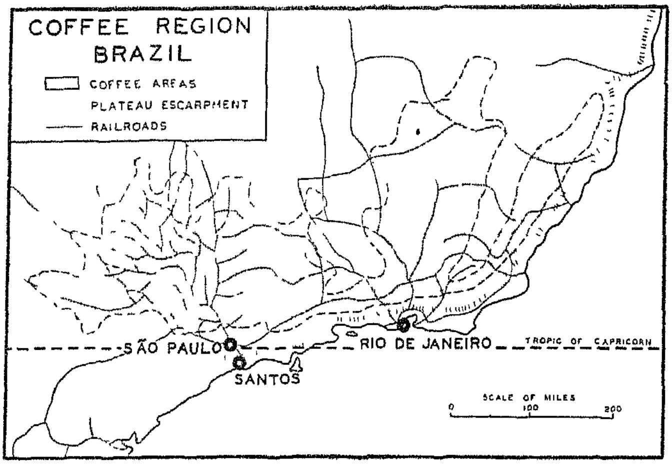
**Brazil's Position in Coffee Production.** Coffee culture began in Brazil in the 1700's, but did not become important until after 1860. Brazil now produces two-thirds of the world's coffee, and the industry has become a very important one. Coffee supplies two-thirds of its exports. The large

[1] Numbers and letters refer to Selected References on pages 420–422



*Courtesy of F [illegible] and the Instituto de Café*

FIG 92 COFFEE FAZENDA RIBEIRAO PRETO, BRAZIL




THE WORLD'S CHIEF COFFEE REGION

FIG 93 Study this map as you read the text

cities of the country depend upon the industry; in fact they have grown as a result of it. Coffee pays half of the nation's taxes No wonder the people and the government do all they can to favor the industry. They have been aided by several excellent advantages.

**A Large Population.** For more than a century many fine immigrants have entered eastern Brazil They provide excellent cheap labor for the coffee industry. They make up most of the people of this section. The population of the coffee region is greater than that of Argentina and Chile combined What does the population map show for this region (p 4–5)?

**Large Area Suitable for Coffee.** Look at Fig. 93. What is the character of the surface? In most coffee areas land at suitable elevations is found only in small strips on steep mountain slopes. But in eastern Brazil the broad rolling plateau, averaging about three thousand feet above sea level, provides an enormous coffee area The plantations of this region would cover all Maryland The area suitable for coffee is estimated to be nearly one-fourth the area of the United States. Nearly level land permits the use of modern machinery and cheap methods on huge *fazendas,* as Cuba grows sugar. On steep mountain slopes of other coffee lands all work is done by hand, a more expensive method.

**A Fertile Virgin Soil and Large Yields.** The rolling plateau land has a red fertile soil, the *terra roxa* It is a fine clay, rich in humus from the grasses and trees on it before it was cleared for coffee. A rolling surface and deep porous subsoil give excellent drainage required by the coffee tree The richness of the soil gives two to four pounds of coffee per tree during the first twelve to eighteen bearing years. When the yields decrease, trees are planted in new soils. New soils give profits to laborer and planter

**Moderate Temperatures.** The coffee estates are on the rolling surface between eighteen hundred and twenty-

five hundred feet above sea level, they lie near the margin of the tropics. These two conditions give the *fazendas* moderate temperatures, which are significant. Immigrants like to work on the plantations, whereas areas nearer the Equator or on lower lands would be more uncomfortably hot. Coffee trees nearer the Equator are injured by the intense heat of the vertical rays of the sun and have to be shaded, like cacao trees. To plant and care for shade trees is expensive. Moderate temperatures in the Brazilian coffee district make shading unnecessary, except for seedlings. This saves much money for Brazilian planters. The hard work of harvesting and preparing coffee is done during the cooler season. Study Chart A (p. 132) and the questions relating to it.

**Freedom from Disease.** We have learned how two diseases are ruining the cacao industry of Ecuador. Coffee trees of Brazil, for the most part, have been free from diseases, although recently a plant disease has invaded the eastern part of the district. Comparative freedom from disease results from four conditions. New lands do not have as much disease as old cultivated lands. Moderate temperatures, much sunshine, and a dry season restrict the development of diseases. Where growers don't have to fight plant diseases, they save much expense.

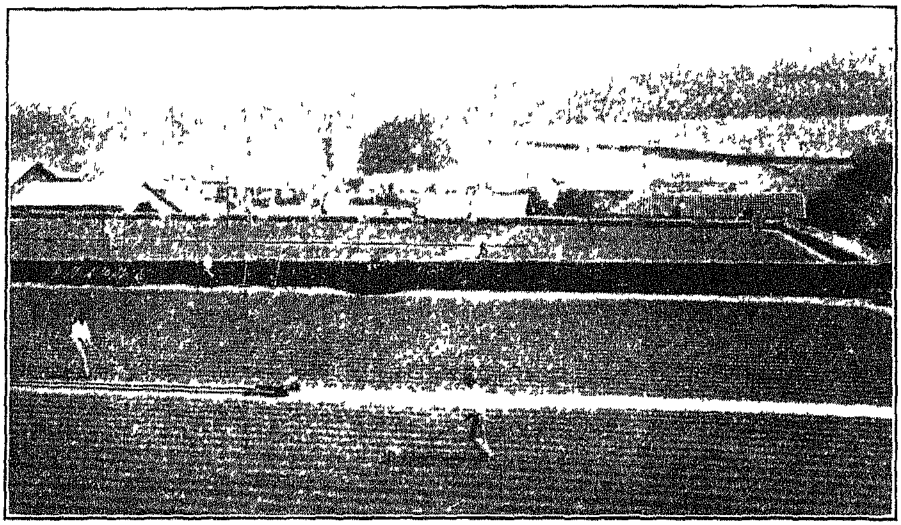
**Adequate Rainfall Properly Distributed.** The coffee region receives from forty-five to sixty inches of rain per year, three-fourths of which falls from October to March, inclusive. This is the period when the fruit is ripening and when the plant needs most moisture. But showers occur every month and coffee trees need moisture all the year for (1) they have no real rest period, (2) they require about ten months to mature the fruit after the blossoms, and (3) they drop many unripe berries during prolonged periods of drought. What do the seasonal maps show you about the distribution of rainfall? The rains come in heavy showers so that work is possible before and after the showers nearly every day during the growing season. At this time weeds are plowed under with a cultivator or cut out two or three times with a hoe.

**Advantages of a Dry Season.** Less frequent rains from April to September give several advantages. Less moisture, more sunshine, and lower temperatures favor the proper ripening of the berries. Harvest begins in May and usually ends in August, and the dry cool season facilitates the gathering of the crop. Whole families engage in picking coffee (Fig. 94). Canvas spread under the trees catch the berries that drop. Children and women strip the lower branches, men climb on ladders to higher branches. The coffee is sacked and hauled to

*Courtesy of T. Prising and the Instituto de Café*

PICKING COFFEE, SÃO PAULO, BRAZIL

FIG. 94. During the busy harvest season clear cool weather favors the picking of coffee. These pickers are Italians, who came in large numbers to the coffee region.



Courtesy of T Preising and the Instituto de Cafe

DRYING COFFEE

FIG 95 An important part of preparing coffee is the drying process What does Chart A (page 132) tell you about the coffee drying season?

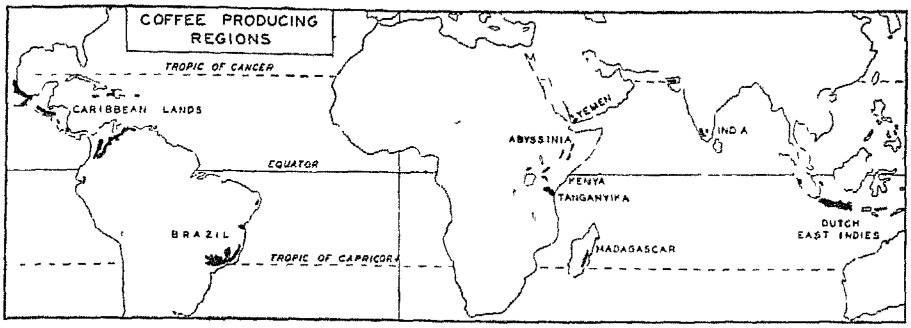
*fazenda* headquarters Cool mornings, warm noon hours, and clear skies are just what the people need. If rain falls, laborers lose time because they are paid by the amount they pick Wet weather would cause the berries to spoil

A dry sunny season is necessary for preparing the coffee for market At the mill the four coverings of the berry are removed by big machines and the beans are washed and dried carefully. To dry they are placed in the sun on large drying floors blackened to absorb heat During showers and at night the coffee is covered with canvas. The coffee is turned with shovels to aid the drying process (Fig. 95) It takes about two months to dry the beans properly The dry season is a good time to cut out dead limbs and prune the trees.

The dry sunny season is also very important at blossom time. Blossoms for the principal crop come in August and September, at the end of the dry season Too much rain at this time would prevent the blossoms from developing fruit.

**Location and Transportation.** How is the location of the region an advantage? Railways have been built to all plantation districts, planters have branch lines to their estates. Many warehouses at junction points store the coffee waiting for exportation. Two railways carry the coffee to Santos and Rio de Janeiro, the great coffee ports, the one from São Paulo to Santos carries nearly half the world's coffee The ports have special loading machinery to transfer the coffee from sheds or railway cars to ships These facilities for moving the coffee are important because Brazil exports most of its coffee.

**Other Coffee Regions.** Because of its advantages few regions can com-




COFFEE REGIONS OF THE WORLD

FIG. 96 All the coffee is grown between the tropics but on plateaus or mountain slopes that have moderate temperatures for a part of the year How do the regions rank (page 130)?

pete with Brazil in coffee production, although there are several important coffee regions in other parts of the world (Fig 96) Most of these produce different kinds of coffee Some kinds are more aromatic and some are milder than Brazilian coffee and so are particularly valuable when used to blend with Brazil's strong coffee.

Highlands of the Caribbean region produce nearly two-thirds of the export coffee outside of Brazil Steep mountain slopes between eighteen hundred and fifty-five hundred feet provide almost ideal physical conditions for coffee The plantations have shade trees and the coffee trees are pruned more than in Brazil The regions have dense populations of good workers. Most of the coffee is transported from the plantations to a railway or river on the backs of steers or mules. The coffee of Colombia moves by boat four hundred miles down the Magdalena to the Caribbean. From the map name the countries and islands producing coffee in Caribbean lands.

For a long time before Brazil became the coffee giant the Eastern Hemisphere produced the world's coffee Today the Dutch East Indies Arabia, and small areas in Africa produce about one-fourth of the export coffee Java and Sumatra grow excellent coffee The government regulates the crop A dense population provides cheap skilled labor The areas lie near the sea Do the rainfall maps indicate favorable rains and dry seasons? Java has very fertile volcanic soils

**Commerce in Coffee.** Trade in coffee is a large world business In average years the world pays about $500,000,000 for raw coffee The United States pays more for its imports of coffee than those of any other commodity except raw silk. Our purchases total about one and a half billion pounds, or about twelve pounds per person. Not many people drink more per person than we do We take about one-half the world's coffee Western Europe takes most of the other half. Can you tell why Asia takes so little? Can you pick out the chief coffee ports of the United States? Of Europe?

## EXERCISES

1 In some detail describe the layout and equipment of a coffee *fazenda* Outline the work throughout the year on a *fazenda*

2 COFFEE PRODUCTION
(Recent 3 year average)

| | *Millions of lbs* |
|---|---|
| World total | 4,037 |
| Brazil | 2,398 |
| Caribbean Region | 1,095 |
| Colombia | 395 |
| Venezuela | 146 |
| Central America | 319 |
| Islands of the West Indies | 142 |
| Mexico | 87 |
| Asia | 302 |
| Netherlands East Indies | 245 |
| British India | 33 |
| Africa | 146 |
| Ethiopia | 30 |
| Kenya | 23 |
| Tanganyika | 22 |

(*a*) What percentage of the world's coffee does Brazil produce? (*b*) List the eight advantages Brazil has (*c*) How large is the coffee area in Brazil? (*d*) What percentage do Caribbean lands produce? (*e*) What percentage does the Eastern Hemisphere produce?

3 List the ways the coffee industry of Brazil differs from that of Colombia

4 List the bases of the large coffee trade between Brazil and the United States

## TWO EXTRA LESSONS

I "The Coffee Industry of Colombia" — **17**, pp 534, 567–572, 578, 589–591, 598–599; **105**, No 37, pp 19–20, **105**, No 110, pp 314–315

II. "Buying, Roasting, and Marketing Coffee in the United States" — Write to Chase and Sanborn, New York, N Y, the Great Atlantic and Pacific Tea Company, New York; the Coffee Publicity Bureau, New York, for pictures and information on the above subjects, **91**, pp 303–330, 379–406, 407–429

## READINGS[5]

"Coffee in General" — **24**, pp 487–494; **9**, pp 297–308, **13**, pp. 366–377, **33**, No 17; **5**, pp. 67–86.

"Coffee in South America" — **17**, pp 569–573, 578, 589–591, 598–599, 631–633, 638–644

"Coffee Industry of Brazil" — **B**, XXVIII (1929), 41–57, **J**, XXII (1932), 225–244; **B**, XIV (1916), 129–134, **7**, II, pp. 293–301; **6**, pp 217–224

"Coffee Industry and Trade" — **12**, pp. 85–101

"Coffee Cultivation" — **91**, pp 197–244

## TOPICS FOR INVESTIGATION AND REPORT

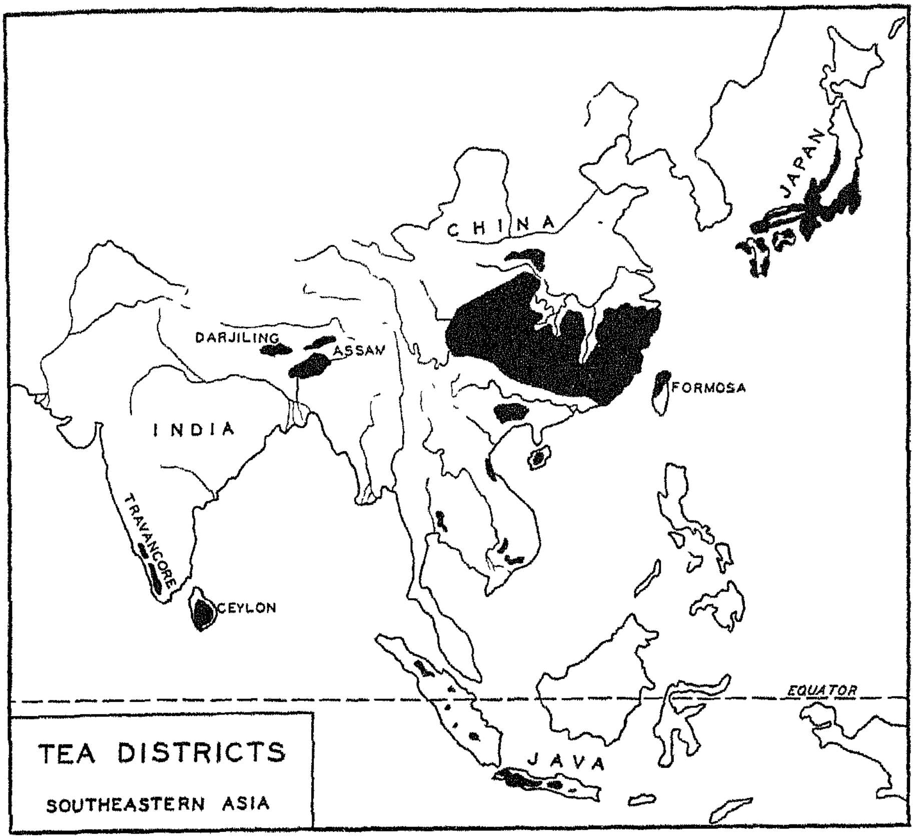
"A Short History of Coffee" — **91**, pp 5–24; **5**, pp 67–71

"Coffee Merchandising" — **91**, pp. 31–36.

"Coffee Industry of Central America" — **A**, VIII (1932), 53–66

"Coffee Valorization" — **33**, No 17, pp. 17–21; **17**, pp. 448–451.

[5] Numbers and letters refer to Selected References on pages 420–424



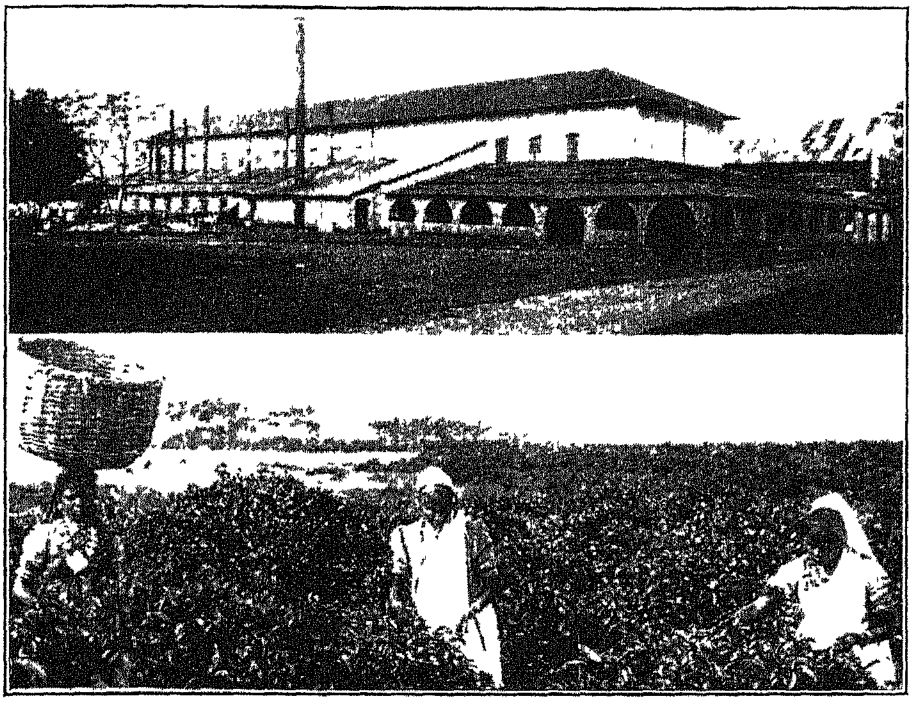

CHIEF TEA REGIONS OF THE WORLD

FIG 97 China has a large tea area but most of the land in the region is used for other crops and most of the tea grown is used at home Name the chief exporters of tea (page 135)

## § V — TEA ON PLANTATIONS AND SMALL FARMS

Tea rivals coffee as a commercial beverage. The world's bill for imported tea is nearly as much as that for coffee, but if we add the enormous consumption of tea in China, the use of tea is larger Outside of China, the world uses about eight hundred million pounds a year, most of which is drunk by the people of the British Empire The United Kingdom and Australia are the chief tea drinkers; they have a per capita consumption of eight and one-half pounds. No other people like tea quite so much The Canadians use about four and one-half pounds. Coffee-drinking peoples use little tea, the people of the United States consume less than one pound per person, the French drink about one ounce.

Tea differs from coffee not only in the people who use most of it, but in the lands producing it Until the nineteenth century China was the great tea producer. The beverage reached western Europe at a later date than coffee For a time, its use grew



*Courtesy of Indian State Railways*

TEA PLANTATION IN ASSAM, INDIA

FIG 99 *Upper* The large tea factory in Assam turns out enormous quantities of tea of uniform quality *Lower* The extensive level areas of tea bushes of Assam are in striking contrast to the hillside tea gardens of China

teas must be sorted and graded Do you wonder why tea is produced only in regions of dense population?

**Tea in China.** Although it does not have the most suitable physical conditions, China produces more tea than any other country In east central China, where a very dense population lives, almost every farmer has a tea garden. Tea generally occupies the soil too poor for food crops Each family prepares its own tea by hand methods It keeps the best for its use and trades or sells the surplus at a small store as the American farmer's wife disposes of her surplus eggs. The store keeper sells the tea of many families to a buyer who exports. By this method it is difficult to get a large consignment of tea of uniform quality. These methods account in large part for China's decline as a tea exporter. The climate is less favorable than in other tea lands, the winter brings comparatively severe weather and the rainfall is lower India has twelve to sixteen pickings during the wet season, Ceylon picks every two weeks throughout the year, but the Chinese tea permits only three or four pickings Frequent pickings give small tender leaves of good flavor.

China still retains leadership in the export of "brick" tea The best grades go to Russia and consist chiefly of tea dust pressed into bricks. Cheaper grades of brick tea, made of leaves and twigs, go to Tibet, where

Courtesy of Japanese Tourist Bureau

JAPANESE GIRLS PICKING TEA

FIG 100 The entire hillside is covered with tea gardens, why is tea grown on hillsides? The girls chant songs as they pluck the tender leaves

the people eat the tea in a stew made with curds and barley

**Tea in India.** India's tea grows in three major areas in Assam, where the slopes of the Khasi Hills receive a very heavy rainfall and where the new soils are fertile; farther west on the slopes of the Himalayas in the high Darjeeling district, which some people say produces the world's finest tea, and in the southwest, where the seaward slopes of Travancore are drenched by the monsoon winds and have a large acreage of tea

The tea is grown on huge plantations owned and operated by the British, they employ modern methods (Fig. 99). Machinery is used in curing the leaves and in packing the tea These methods give large consignments of tea of uniform grade, a condition which pleases foreign buyers railways take the tea to the ports When the industry began about the middle of last century, the growers levied an excise tax This has continued in force and has given, through the years, huge sums of money for advertising Indian teas in foreign countries The United Kingdom imports about seven-eighths of India's output The Indians themselves use less than one ounce per person.

**Tea in Ceylon.** The heavy frequent rainfall of the mountain slopes of Ceylon makes this region one of the most productive in the world. As in India, modern methods of tea culture prevail Thousands of laborers are imported every year from the mainland to pick and prepare the tea

**Tea in the Netherlands East Indies.** Java has made a great success of tea production. It has mountain

rainfall, dense population, and uses modern equipment Note the growth of exports (p 135) Who imports Java teas and why?

**Tea in Japan.** Japan has favorable factors for tea production But the industry is hampered by the small area available, in this densely settled country which is so small the best land must be used for food crops Japan grows its tea both for home use and for export Nearly all the exported tea comes from near Shizuoka on the east coast, where modern methods are used The farmers and manufacturers of this area have made an international reputation, so fine are their green teas, produced and shipped on a large scale (Fig 100) Their tea has to compete with teas produced in India, Ceylon, and Java. Nevertheless, Japanese tea has an important place in the North American markets More than 90 per cent of the exports go to the United States and Canada On terraced slopes in northern Formosa grows the famous Oolong tea Most of this goes to the United States

## EXERCISES

TEA EXPORTS

(In millions of pounds)

| *Year* | *India* | *Ceylon* | *China* Black and Green | *China* Brick | *Java* | *Japan* |
|---|---|---|---|---|---|---|
| 1887 | 98 | (a) | 200 | 80 | 7 | (a) |
| 1897 | 150 | 110 | 162 | 79 | 9 | 42 |
| 1907 | 236 | 171 | 130 | 79 | 27 | 31 |
| 1917 | 293 | 208 | 120 | 79 | 98 | 41 |
| 1927 | 337 | 217 | 98 | 12 | 105 | 25 |
| 1931 | 364 | 242 | 86 | 6 | 135 | 21 |
| 1933 | 360 | 247 | 82 | 7 | 132 | 30 |

(a) Figures not available

1 Study the table of tea exports. (*a*) Who were the great exporters in 1887? (*b*) Trace the increase in exports of India (*c*) List several reasons to explain why the exports of India increased so greatly. (*d*) What percentage of the world's exports comes from India and Ceylon? (*e*) Dutch East Indies?

2. Why have the exports of China declined so greatly? 3. Ceylon's and Java's have increased Why? 4 (*a*) Who buys the teas of India? (*b*) Of Japan? (*c*) Of Java?

5. (*a*) List the major ten producing areas (*b*) Which grow tea on small farms? (*c*) On huge plantations? 6 (*a*) Using the text, maps, and rainfall charts, contrast tea production in Assam and eastern China (*b*) List six or more conditions that favor tea production and exportation on a huge scale in Assam

## READINGS [6]

"Tea in Assam, India" — B, XXIII (1924), 181–188, B, XXXIII (1934), 151–156.

"The Tea Crop" — B, XXVIII (1929), 1–25.

"Tea — General" — 24, pp 497–504; 2, V, pp 33, 52, 75–87, 333–334, 389–390, 406–407, 424, 13, pp. 378–401; 5, pp. 103–110; 27, pp. 95–99, 158–159, 176–179, 195–196, 305–309; 7, IV, pp. 90–92, 186–187; 18, pp. 284–290; A, IX (1933), 131–133.

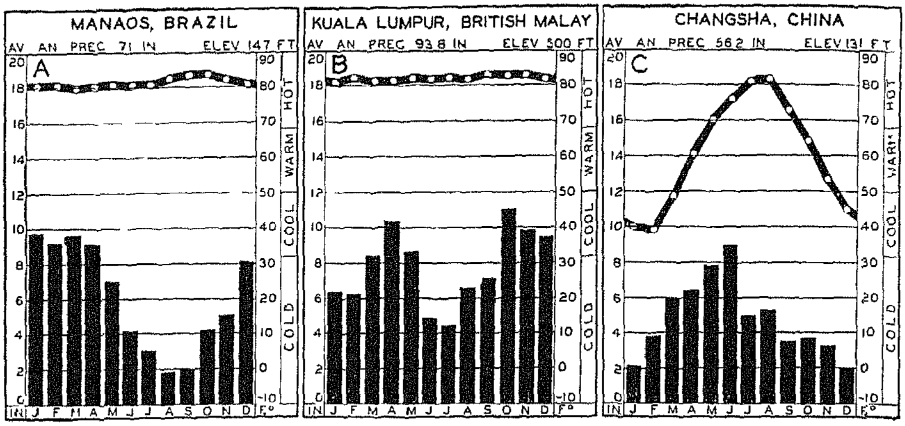



FIG 101 Chart A shows the temperatures and rainfall in the native home of the rubber tree and Chart B of the great rubber plantation area of British Malaya

## § VI — FROM WILD TO PLANTATION RUBBER

**Early Use of Rubber.** Of the major plantation crops, rubber has had the most remarkable development A hundred years ago it was only a curiosity, today the world uses more than one and a half billion pounds per year. It goes into thousands of articles, scientists find new uses for it continually.

The industry started when some one discovered that a resilient substance, used as a toy by the Indians in Brazil, erased pencil marks. Thus the name "rubber" is explained For some time erasers were about the only practical use for the material, scientists experimented with rubber as a waterproofing material, but in warm weather such a raincoat became gummy and in cold weather it became so stiff that it could stand alone In 1839 the discovery that gave the rubber industry its real start was made We know this now as the "vulcanization" of rubber; it consists of mixing sulphur and rubber to make the rubber elastic and less responsive to temperatures This gave a great impetus to gathering rubber in the hot rain forests of Brazil. Soon every country with land in the Amazon basin began to collect rubber, practically all of the shipments going down the Amazon River.

**The Climate for the Rubber Tree.** There are many rubber-producing plants, but nine-tenths of the world's supply comes from rubber trees native to the Amazon basin. These trees require great warmth and much moisture, the best conditions being even temperatures of about 75 to 85 degrees, rainfall of five or more inches every month, relative humidity of 75 to 80 per cent, and little wind (Fig 101)

**Wild Rubber Industry.** Until early in the nineteenth century, the Amazon region produced all of the world's rubber. Here the trees grow by the million They are scattered widely through the forest. The remotest part of the forest may shelter the rubber-smoker's hut. Even today, when the industry has greatly declined, it fur-

nishes the main means for a living to a large percentage of the people Not many people live in this hot unhealthy region, laborers come in from other areas of Brazil The rubber gatherer travels for miles through the wet forest stopping at each tree he taps Each morning he makes a gash

*Courtesy of Pan American Union*

SMOKING RUBBER IN A BRAZILIAN SHACK

FIG 102 The ball evenly coated with latex dripping from pan before placing the ball again over fire for smoking The rubber is smoked in successive layers

in the bark of the tree and places a receptacle under it to catch the "latex," a milky liquid He may visit a hundred trees. He returns by noon to collect the latex and spends the afternoon by a smoky fire dipping a wooden paddle into the latex and holding it in the smoke until the latex becomes solid (Fig. 102) This is hard work and the rubber may be dirty. The gatherer cannot collect rubber during the rainy season because of flooded streams and water-soaked ground The cost of producing wild rubber is high.

Brazil exported ten million pounds of rubber in 1870; these increased to ninety-three million pounds in 1912 As long as the world demand for rubber depended on bicycle and buggy tires, clothing, and boots, Brazil was able to meet the needs until 1909 it produced practically the entire world supply

**The Transfer of the Rubber Industry.** In the 1870's rubber seeds were smuggled from Brazil to London and to Ceylon. They were planted on experimental farms, the people learning much about the rubber tree Young trees were set on plantations in Ceylon, Malaya, India Burma, and the Dutch East Indies. Planters didn t know much about rubber, but certain conditions led many of them to plant trees In Ceylon many large coffee estates planted rubber trees to take the place of coffee trees which had been killed by a blight At the same time planters in Sumatra and Java were getting low prices for their tobacco They knew how to manage a tropical plantation and were glad to try rubber.

Thus, in a short time, rubber changed from a wild product to a plantation crop. In 1900 only four tons of crude rubber came from plantations By 1914 plantations produced more rubber than the gatherers of the Amazon region and plantations now produce 96 per cent of the world's rubber.

**The Plantation Rubber Industry.** Figure 103 shows the chief areas of plantation rubber production The Amazon region has ideal physical conditions, it is the native home of the tree. But the plantations of southern Asia also have excellent physical conditions and in addition have three great advantages not possessed by the Amazon region.

Malaya and Sumatra have, on the coastal plains and low hills of the central mountain range, large areas of unoccupied land. Here deep clay

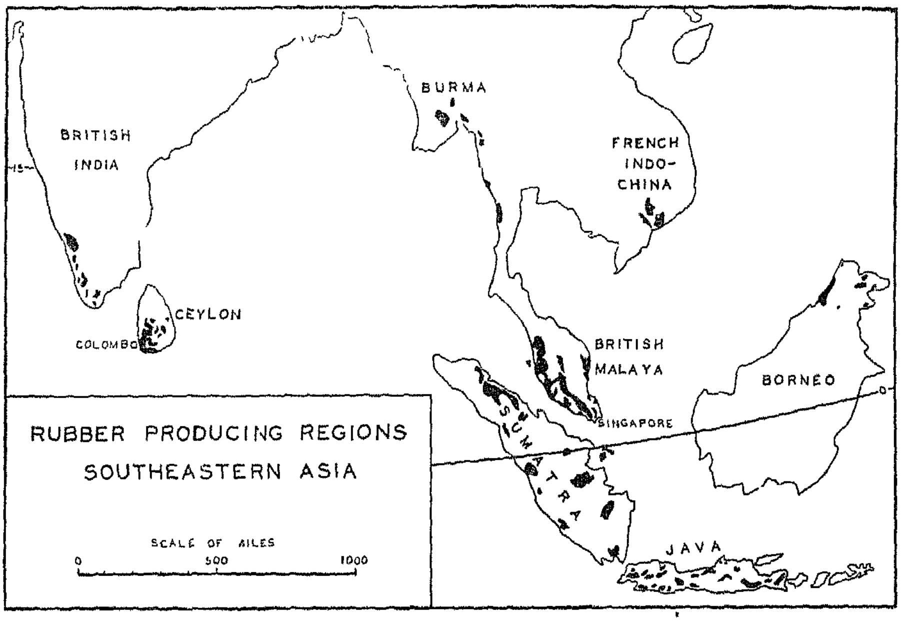



FIG 103 With this map, the map on page 13, Chart B on page 136, and the map on page 5, list all the factors that favor rubber culture in this region

loam soils, which are loose and well drained but hold moisture, allow the tap roots to grow ten feet deep.

The plantations have high temperatures all of the time and a rainfall of seventy to one hundred twenty inches a year with no long drought periods Under these conditions the rubber tree grows rapidly. At the age of five years the trunks may be eight inches in diameter These vigorous trees yield a large flow of latex Because of high even temperatures and heavy rainfall, trees are tapped regularly throughout the year except for a few weeks during the less rainy period. The long season of flow gives a much larger yield from plantation trees than from the wild trees of Brazil. Also a long season makes the best use of the labor supply.

One of the great advantages Sumatra and Malaya have over Brazil is the labor supply. What does the population map tell you about the people in this region (p 5)? Chinese laborers are used in Malaya, Javanese in Sumatra and Java, and Tamils from southern India in Ceylon These people are much better workers than the natives of the Amazon region Many of them have learned so well how to grow and prepare rubber that they have their own farms About one-third of the rubber acreage is owned by native farmers Most of their farms are small, in many cases only an acre, but all together they produce much rubber. These people are also excellent laborers on huge plantations owned and managed by the British and the Dutch

The great amount of foreign capital, foreign managers, and skill constitute the second advantage this region has over Brazil. Estates are laid out like large coffee plantations. In addition to rubber they grow food

crops, pasture, and timber When the rubber trees reach tapping age, about six years, laborers by modern methods collect the latex with least injury to the tree (Fig 104) In the

*Courtesy of Rubber Growers Association*

RUBBER PLANTATION IN SUMATRA

FIG. 104 These trees, scientifically tapped, yield more and better rubber than the wild trees of Brazil These men are more efficient than the laborer of the Amazon basin

Amazon region countless trees were destroyed by crude tapping. Figure 102 shows the Amazon laborer smoking rubber over a wood fire, if carefully done this is a good method, but slow After smoking it the laborer piles the rubber in a small boat and brings it to a river port. In a factory on a plantation in Malaya or Sumatra the latex is first strained, then poured into a large tank. A chemist adds a quantity of a coagulating substance and in an hour an attractive white spongy mass of rubber appears (Fig 105). This goes into a rolling machine, whence it issues as a crêped ribbon several inches wide and about one-eighth of an inch thick It is then cured and tightly packed for shipping. Do you wonder that plantation rubber has replaced wild rubber? Indeed, the industry lately has developed too rapidly, not enough markets being available for the output, even with the great demand for automobile tires So great has the output become on these fine plantations that the producers, in order to keep the price of rubber above the cost of producing it, have all combined to limit the amount they will export

The third big advantage of Malaya and Sumatra is transportation facilities Where are the plantations located? In Brazil the rubber trees are hundreds of miles from the sea, but in Malaya the estates are along government railways and in areas near small ports served by coasting steamers In Sumatra plantations lie near the sea, each estate having its railways, roads, or streams to transport the rubber to a small port where it is picked up by small boats What does the map show you about the location of the estates with reference to Singapore? Singapore stands at a focus of ocean routes, is visited by many ships, and therefore has ample space for rubber cargo Nearly all the world's rubber moves to North America and Europe for manufacturing.

*Courtesy of Rubber Growers Association*

TRANSPORTING LATEX

FIG 105 Bringing in latex by bullock cart and human porter In this large plantation factory rubber of high grade is cheaply produced and packed for market

## EXERCISES

RUBBER PRODUCTION

(In long tons)

| Year | World Total | Wild Rubber | Plantation Rubber Southeastern Asia |
|---|---|---|---|
| 1900 | 53,890 | 53,886 | 4 |
| 1910 | 70,500 | 62,300 | 8,200 |
| 1920 | 343,731 | 38,915 | 304,816 |
| 1930 | 792,055 | 15,415 | 776,640 |
| 1933 | 848,029 | 12,620 | 835,409 |

1 (*a*) What percentage of the world's rubber was wild rubber in 1910? (*b*) 1930? (*c*) Why did rubber production increase so rapidly between 1910 and 1933?

2 How was rubber first used?

3 Explain in detail how the wild rubber industry is carried on

4 Why was rubber introduced into southern Asia?

5 What climatic conditions does the rubber tree require?

6 What three advantages have Malaya and Sumatra over Brazil?

7 (*a*) What percentage of the world's exports of rubber comes from Malaya? (*b*) Dutch East Indies (p 160)? (*c*) What two regions manufacture most of the world's rubber products (pp 362–363)?

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[7] Numbers and letters refer to Selected References on pages 420–424

CHAPTER XIV

# FARMING IN MONSOON LANDS

## § 1 — THE CHARACTER OF MONSOON AGRICULTURE

Great farming areas are in the monsoon lands of China, Japan, India, and the East Indies (Fig 106) They are more purely agricultural than areas in Europe or North America, comparatively few people engage in grazing or manufacturing, in China nearly 80 per cent of the people are wholly or in large part engaged in agriculture In Japan 50 per cent of the people are farmers These areas are the most densely peopled of the major farming regions They are the oldest large agricultural areas in the world and have the most intensive methods of farming.

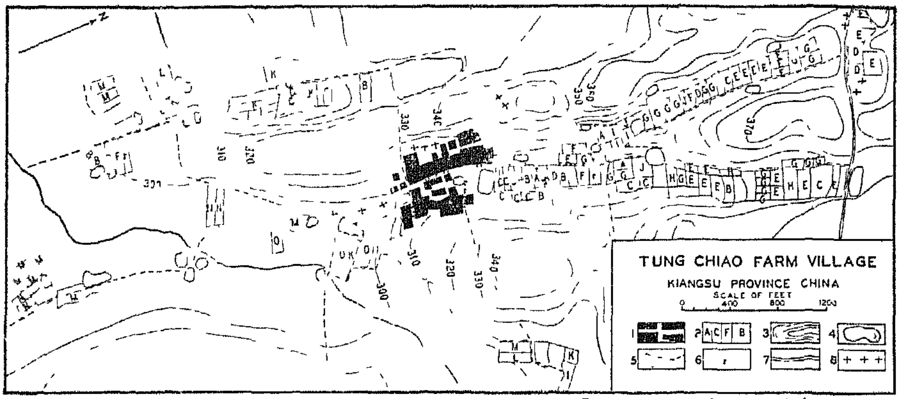
**A Chinese Farm Village.** Figure 107 represents a typical farm village showing the farm plots in a low hilly region in a rice-growing district of east central China The finger-like projections of farm plots in the northern part of the map broaden out in the south into large level rice fields below the 300-foot contour line These plots are not shown on the map because they belong to the farmers of another village Much of the hill land is in grass or trees which supply pasture and fuel Graves occupy nearly 5 per cent of the hill land Nearly all farm plots are used for rice. Each field is bordered by a ridge usually covered with grass The ponds provide water for irrigating rice fields. They are near the foothills so as to catch water and so as to be high enough to irrigate the plots by gravity The water is pumped from the ponds by wooden chain pumps. What is the distance between the two most distant plots farmed by Farmer B? How many plots does Farmer B have? Which farmer has the largest number of plots? Fertilizers are carried from the homes to the plots on the backs of men, the crops are carried from the plots to the village in the same manner For several reasons it is impossible to use a large threshing machine in this region

*Courtesy of Japan Tourist Bureau*

PULLING RICE IN NURSERY

FIG 106 An intensive method of farming, where nearly all the work is by hand, supports a very dense population — in some areas as many as three thousand per square mile Rice is important in monsoon lands, it is the chief food of millions of people. Its culture requires much hard hand work In the middle distance a paddy has been planted to rice and flooded

Non-contiguous farm plots have several advantages In a hilly region like this each farmer has a plot of the best valley land and some hill land He has different types of land adapted to different crops Hill land supplies him

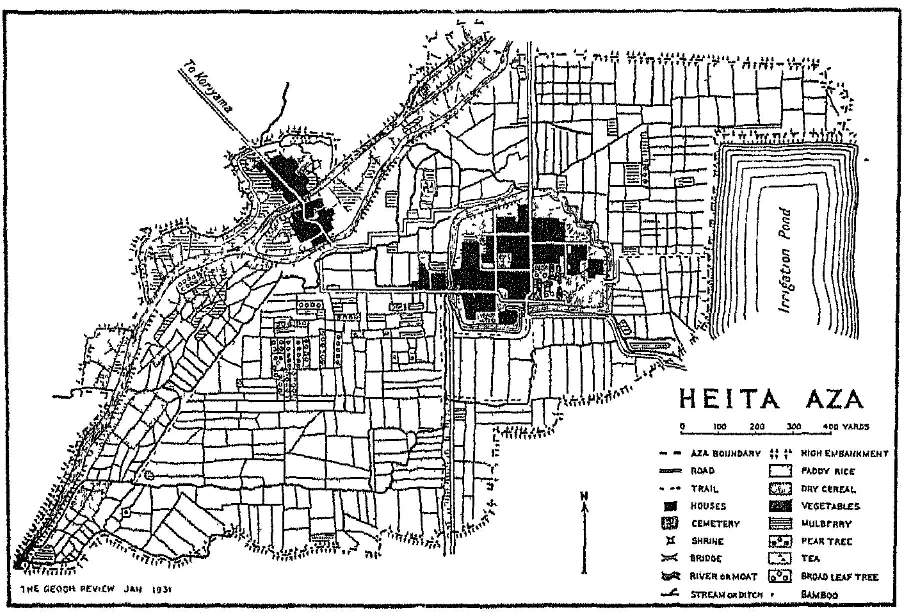



*Drawn from a Map by John L Buck*

A FARM VILLAGE IN HILLY LAND OF EAST CENTRAL CHINA

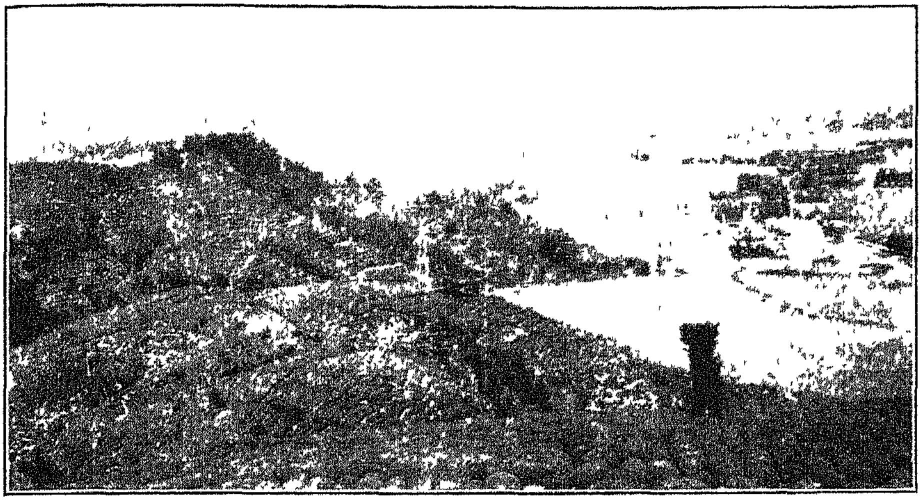
FIG 107 1, Farmstead and buildings in the farm village 2 Farm plots — all the plots marked "A" are farmed by Farmer A 3, Hills in graves and grass — the numbers on the contour lines represent feet above sea level 4, Ponds for irrigation and fish 5, Earth paths 6, Paths paved with eighteen-inch stone slabs 7, Paved stone road seven feet wide 8, Buddhist temples

with fuel of grass and bushes and with green manure of grass for the rice fields The farmers cooperate and rotate wheat followed by rice in all the plots of one section, and barley with soy beans in another section This favors irrigation as the irrigated fields are contiguous each year, even though they may belong to many different farmers The farmers say that by having scattered pieces of land they escape the ravages of locusts Also, the dan-




*Courtesy of Geographical Review, published by the American Geographical Society*

FIG 108 A JAPANESE FARM VILLAGE, YAMATO BASIN



Courtesy of Glenn T. Trewartha

JAPANESE TEA GARDENS AND RICE PADDIES

FIG 109 The steep slopes are almost entirely covered with tea gardens, the low alluvial plain is covered with rice and other food crops Notice the large cotton textile mill at the base of the hill and the farm villages in the plain

ger from flood is lessened Fifteen farm families live in this village Each family has an average of about five acres of land The pattern of a farm village in another part of China would be quite different from this. On the large plains the farms are irrigated by canals, streams, and wells On the plains the farm plots are larger.

**A Japanese Farm Village.** On Fig. 112 locate Yamato Basin. Heita Aza is a farm village in the low alluvial plain of Yamato Basin (Fig 108). Seventy families live in the village and work small farm plots. Each farmer has several plots. The population density in the basin is three thousand per square mile. How can the land support so many people? Nearly 94 per cent of the crop land grows rice, 4 per cent mulberry and pear orchards, and 2 per cent dry cereals; also about 78 per cent of the paddy rice land grows a winter crop of dry cereals, chiefly barley and wheat. Nearly every foot of the low alluvial plain is used The farmers use much fertilizer, till the land by hand, flood the fields several times during the season, have only narrow paths between the fields, and use almost no land for animals, except poultry and pigs

**Intensiveness of Monsoon Agriculture.** To anyone accustomed to an American farm, the intensiveness of agriculture in these regions is striking The United States has more than three acres of cultivated land for every person, whereas Japan has less than three-tenths of one acre, China only one-half of an acre, and India about one acre The people in these crowded lands are too poor to obtain quantities of food supplies from other regions. Thousands of square miles of farmland in monsoon areas look more like gardens than farms (Fig. 109). Despite countless years of cultivation, some of these little farms, especially in Japan and China, produce big crops. The people

had to become skilful farmers, or they would have starved long ago. Here originated the idea of crop rotation to preserve the fertility of the soil. Farmers use every available sort of fertilizer. Great rivers frequently flood the lands and bring new life to the soil. Every time rice fields are flooded, the water leaves a thin layer of mud. In addition to careful soil maintenance, we find the growing season

*Courtesy of Wallace W. Atwood*

PLOWING RICE LAND WITH WATER BUFFALO, CHINA

FIG. 110. Why doesn't this farmer use modern machinery?

used almost to the very last minute; more than one crop a year in some sections is common. In many cases a second crop is sown before the first is harvested, so that the new crop may get a start while the old crop is being gathered. Where population is so dense and land so scarce, terracing and irrigation also are highly developed. Some of the engineering feats of farmers in these lands in producing crops on mountain sides are among the wonders of the world.

**Place of Animals.** In regions having so little cultivated land per person, what place have animals in agriculture? Japan with 60,000,000 people has only 480,000 cattle, 760,000 swine, 19,000 sheep, 200,000 goats, and 1,490,000 horses. The United States with twice as many people has forty times as many cattle, seventy-five times as many swine, twenty-five hundred times as many sheep, sixteen times as many goats, and nine times as many horses. On what do the Japanese depend for meat? In China the situation is somewhat better. China has 20,000,000 cattle, but the people eat little beef, because these cattle are chiefly used for draft animals (Fig. 110). The great meat provider for China is the pig, the country having as many swine as the United States. Every farmer has a few to utilize each scrap of edible refuse. The Chinese raise enormous numbers of several kinds of poultry; eggs are sold even in American markets. In India we find a strange situation, for the country has three times as many cattle as the United States, yet the people eat little meat. In most of India the cattle are sacred animals not to be eaten, although they may be and are used as draft animals. The chief source of meat and dairy products is the goat, of which India has more than any other country and against the use of which there is no religious ban. Besides using cattle as draft animals, the Indians have almost 40,000,000 water buffaloes, suited especially to the rice regions.

## EXERCISES

1. (*a*) List the chief farming areas of monsoon lands (p. 103). (*b*) What percentage of the people of China and Japan are engaged in farming? (*c*) List the conditions that make these land areas of intensive farming.

2. Study Fig. 107. (*a*) Why do the farm plots extend north from the village

in two narrow strips (*b*) Answer the questions on p 141 (*c*) Why is it impossible to use a threshing machine in this region? (*d*) List the advantages of non-contiguous farm plots (*e*) How are the ponds used? (*f*) Of what use are the hill lands?

3 Study Fig 108 (*a*) How many families live in Heita Aza? (*b*) What different crops are grown? (*c*) List the conditions that make it possible for this land to support three thousand people per square mile (*d*) How do the farmers get their fertilizers and tools from the village to the plots and the cereals to the village?

4 How are the hill lands used in China and Japan (p 158)?

5 (*a*) Why should China and Japan have so few cattle? (*b*) So much poultry and so many swine?

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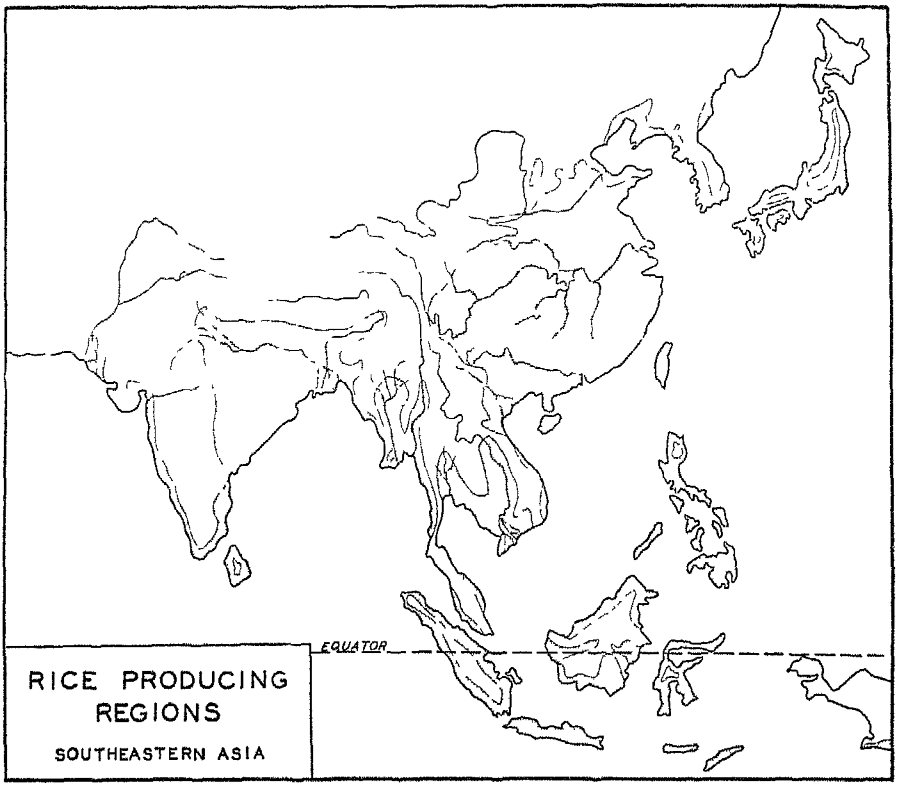
## § II — RICE IN MONSOON AGRICULTURE

Rice is the most distinctive and most important product of monsoon lands. On the success or failure of this crop depends the welfare of millions of people Compare the rice map (Fig 111) with the distribution of people in southeastern Asia; can you find some regions of dense population that do not produce rice?

Rice is the world's biggest and most valuable crop It is worth as much as the world's wheat and corn crops combined In Japan it occupies more than half the cultivated land, in China and India more than one-quarter, everywhere in the moist warm lowlands from India to Japan it is the main crop while in many drier highland districts an upland variety is grown In India rice grows on almost as much land as

[1] Numbers and letters refer to Selected References on pages 420–424




THE CHIEF RICE REGIONS OF THE WORLD

FIG 111. What relation exists between relief, river valleys, and rice areas?

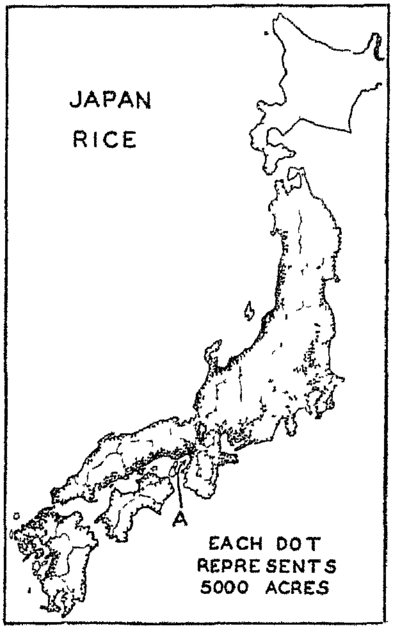
wheat occupies in both the United States and Canada What conditions recommend rice to these lands?

**The Quality of Rice.** One of the major qualities is the high yield of palatable and nutritious food. To secure the high yield an enormous amount of labor is necessary, but these lands have millions of laborers. The average acre of rice in Japan and China yields forty bushels of sixty pounds each. The average acre yield of wheat in the United States is fifteen bushels of sixty pounds each. Even in India, where agricultural methods are extremely crude, the average is about fourteen bushels per acre. As rice contains less gluten than other cereals, it does not make light bread, but on the other hand it contains less fat and less protein than wheat and keeps much better, a quality of great importance in humid lands

**Rice and the Climate.** A second major quality is adaptation to climate. Rice requires a warm humid climate, with an annual rainfall of at least fifty inches and five inches or more during each month of the growing season. Study the maps of seasonal distribution of rainfall (pp. 62–63) to learn which parts of southeastern Asia favor rice. You find that they comprise a large area What does the temperature curve in Chart C, p 136, tell you about the growing season for rice?

**Soil and Rice.** How do the areas of heavy rainfall compare with the areas of highland and lowland? For the people of the Orient it is lucky that the broad river plains, like those of the Ganges and Yangtze Kiang, have enough rainfall for rice, as rice has particular requirements as to the type of relief and soil Upland rice does not have such close requirements, but it yields only half as much grain as swamp rice, the chief variety For large yields, the fields must be flooded at frequent intervals during the growing season, which is possible only in level land like that of the river plains or of man-made terraces. Also, if the soil be porous to a depth of several feet, the water will drain too rapidly, the best rice lands are those with a loam that can be easily crumbled overlying a heavy clay. Thus the loam permits good root development while the clay prevents a rapid draining away of the waters Coastal lowlands, especially deltas, are ideal for rice (Fig. 112).

**How Rice Is Cultivated.** Throughout monsoon lands the methods of raising rice are much the same Hand labor is used almost entirely and fortunately there is plenty of this Even in the most productive districts like those of Japan and Formosa, practically no machinery is used The people are too poor to buy machinery and the flat flooded lands are too soft and the fields too small for machine agriculture Every step in rice cultivation makes huge demands upon labor. First the land must be divided by low ridges into small flats With the coming of the first rains, ordinarily in April and May, plowing begins. The land is usually plowed with a tiny wooden plow dragged by plodding buffaloes or oxen, in many cases it is spaded by hand (p. 144). Meanwhile the young plants have been started in special nursery plats When they are about six inches high they are set out one by one about a foot apart in wet soil (p. 141). Then the fields are flooded In this warm water the rice grows very rapidly. Caring for the rice while it grows is hard work. The plants must be weeded, leaving the roots undisturbed To do this women and men wade in the water through the fields often singing as they work. Fields are hoed, fertilized, and reflooded As the grain begins to ripen the water is drawn off to allow the




*After the United States Department of Agriculture*

RICE AREAS JAPAN

FIG 112 Most of the rice of Japan grows on the low flat coastal and river plains and on the lower slopes Much of the farm land of Japan grows two crops of foodstuffs each year. A — the Yamato Basin (pp 142, 158)

*Courtesy of Japan Tourist Bureau*

FIG 113 CUTTING RICE WITH HAND SICKLE

ground to dry and harden The harvest period is during the dry season

**Harvesting, Threshing, Cleaning.** From harvest to the rice bowl another series of laborious operations is necessary. Millions of acres of rice are harvested with a hand sickle (Fig 113). The rice is tied in bundles by hand and set in shocks or carried on the head or back to long racks and hung up to dry (Fig 114) Most of it is threshed by drawing the grain through the teeth of a metal comb (Fig 115), but in some districts oxen or buffalo walk round and round upon a threshing floor to separate the grain from the head The grain is then winnowed, sacked, and stored for use These people in most places do not polish the rice as we do, as polishing removes a valuable food element from the grain

*Courtesy of Japan Tourist Bureau*

HANGING RICE ON POLES TO DRY

FIG 114 The narrow ridge on which the men are standing separates the rice paddies and is used as a path to carry the rice to the poles After drying, the rice is carried to the threshing floors Why do they dry the rice on poles?

**Commerce in Rice.** The trade in rice reaches enormous proportions, the principal markets being in southeastern Asia in lands which are unsuited to the production of rice, have had a poor season, or where the people devote their principal attention to inedible crops The main exporting countries are eastern India, Siam, and Indo-China India annually ships about five billion pounds, 85 per cent of which

*Courtesy of Wallace W Atwood*

REMOVING THE GRAIN FROM THE STRAW

FIG 115 Every step in growing and preparing rice represents hard work

comes from Burma, where rains are so regular that crops rarely fail Two-thirds of Burma's cultivated area grows rice and three-quarters of the population engages in rice cultivation, milling, or transportation. Siam and Indo-China are also heavy exporters of rice, a great majority of the people in each case being connected with rice culture. The major importing countries are China, British Malaya, Japan, Dutch East Indies, and Ceylon Give what you consider the main reason for the rice imports of each country. Outside of southeastern Asia the principal rice markets are Germany, France, Cuba, and the United Kingdom Where does the United States get its rice?

## EXERCISES

1 List several conditions that favor the growth of rice in the monsoon lands of southeastern Asia

2 What conditions make the flooding of the rice fields fairly easy?

3 In what different ways does the dry season favor the harvesting and preparation of rice?

4. Why is it impossible to use large modern machines in rice cultivation in Japan and China?

5 Why are rice and fish a good food combination in southeastern Asia?

6 Turn to the table, p 153, and find what percentage of the world's exports of rice come from southeastern Asia (*a*) What part of India exports rice? (*b*) Explain why India (Burma), Siam, Indo-China, Korea, and Formosa export rice (*c*) Where does most of the rice from each region go?

## AN EXTRA LESSON

"Rice Culture in the United States" — 101, No 1092; A, III (1927), 63–64, B, XXXI (1932), 137–147, 3, pp 283–292

List the ways rice culture in the United States differ from that in the monsoon lands of southeastern Asia

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## § III — OTHER FOOD CROPS IN MONSOON LANDS

While rice overshadows other agricultural interests of the region, other crops are important. Millions of people in southeastern Asia, chiefly in northern China and in central and western India, do not eat rice. Some of the crops are familiar to us, such as wheat, barley, corn, and beans, but two important classes of grains are not, namely millets and grain sorghums.

**Millets and Grain Sorghums.** In the United States and in parts of Europe, millets and sorghums are often used as forage, but in southeastern Asia they furnish human foods Over broad areas, where rainfall is less than forty inches, they constitute staple foods.

[2] Numbers and letters refer to Selected References on pages 420–424

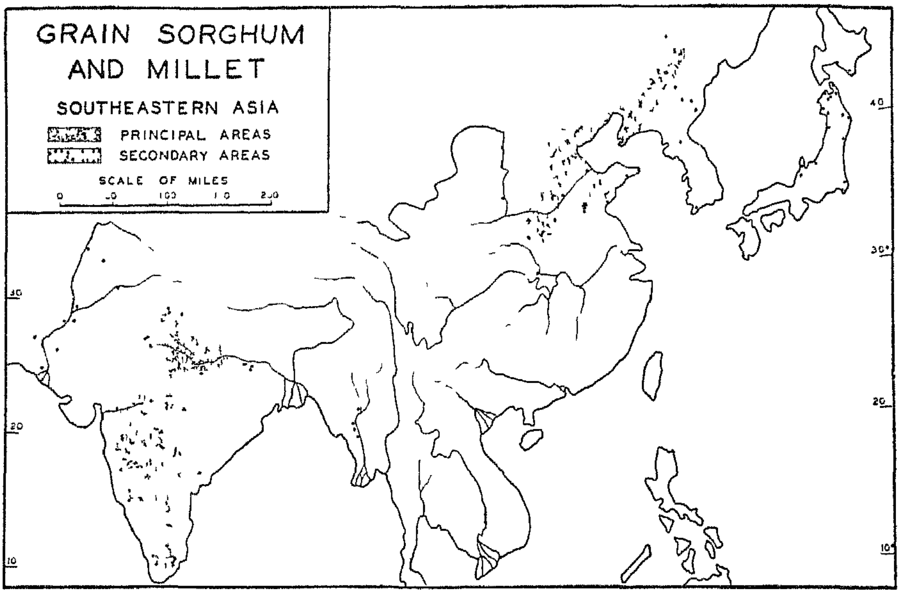



FIG 116 In areas too dry or hilly for rice, millet and grain sorghum are very important food crops What is the population density in these areas (page 5)?

In India they rank next to rice, in China next to rice and wheat In India one-seventh of the area cultivated is in these crops, in China one-fifth. Compare the map of millet and grain sorghum (Fig. 116) with the rainfall maps of this region How much is the annual rainfall in the chief millet and sorghum region of India? In that of China? Do these regions get any rain during the dry season? In many sections areas too dry for rice grow millet and sorghum because these crops resist dry weather and still give fairly good results Do you find any rice regions in areas producing these crops?

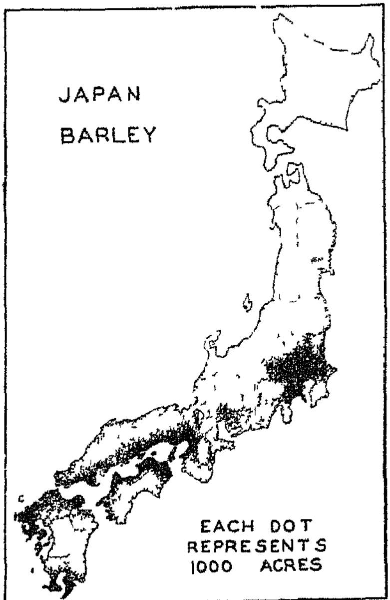
**Wheat.** Wheat rivals millet and grain sorghum as a principal crop. It is cultivated less than other food crops only because the climate is less favorable. One-fourth of China's farmland produces wheat, which grows chiefly in the drier and cooler region north of the Yangtze Kiang River. Winter wheat is the chief variety. The acreage exceeds that of rice, but the output is much smaller. Can you explain why? In India wheat is grown principally in the northwest, in the Punjab In area wheat ranks as the third food crop of India (Fig 117). Compare the wheat areas of India with the rainfall maps In areas producing wheat the annual rainfall varies from about eight to forty inches. Nearly half the wheat is grown under irrigation. Wheat is planted in October, after the monsoon rains cease It is harvested by hand in the Punjab in April or May and farther east and south in February and March. Can you explain why lower temperatures and dry sunny air of the winter season favor wheat culture? Why is it important for India that she can grow wheat during the dry season?

**Barley.** Barley grows in dry hilly and in low rainy areas It supplements other food crops In Japan barley ranks as the second cereal crop, where it is important in the uplands

and grows during the dry season after rice has been harvested on the lowlands What percentage of the rice land in Heita Aza village grows a winter crop of barley and wheat (p 143)? The principal areas are on the southern slopes which get the summer monsoon rains (Fig 118). In Japan barley mixed with rice is a common food of the country people

**Other Foods.** While these cereal crops are important, many other foods are produced In India, the Malay Peninsula, and the islands of the East Indies corn is a valuable food In the Philippines it ranks next to rice In most sections beans, vegetables, and fruits are grown Beans serve to provide a balanced diet Also the soy bean is a good food for animals and is used for making industrial oil and as a fertilizer. It occupies one-fourth of the cultivated land in Manchuria It rivals silk as China's chief export

In China, as in other sections of southeastern Asia, each farm produces a meat supply. Nearly every farm has a few swine and a flock of chickens,




*Courtesy of United States Department of Agriculture*

BARLEY AREAS JAPAN

FIG 118 Explain why rice and barley grow in the same areas (page 147).

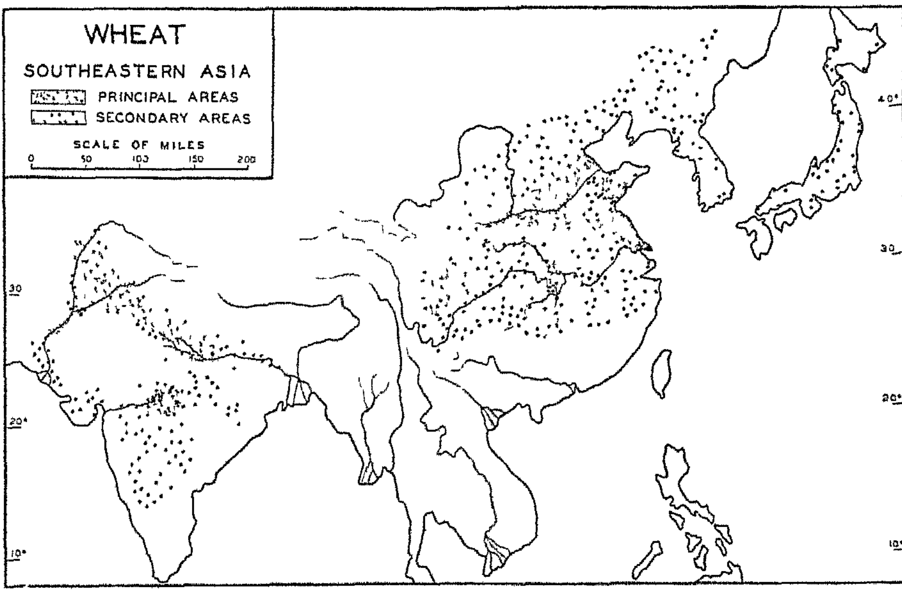
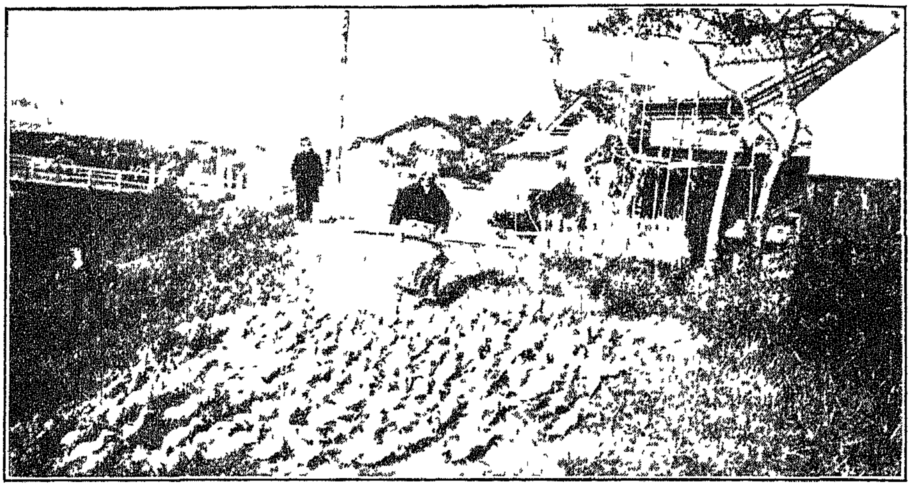



FIG 117. WHEAT REGIONS OF SOUTHEASTERN ASIA



*Courtesy of Wallace W. Atwood*

A FLOCK OF DUCKS, CHINA

FIG. 119. In this region of dense population and intensive agriculture, poultry supply much food.

ducks, or geese (Fig. 119). They live largely on refuse, materials that otherwise might be wasted. They take up little room, an important factor in densely populated regions. They reproduce rapidly and are easily and quickly prepared for eating or for market. Eggs form a valuable food. These foods with the cereals provide a balanced diet.

## EXERCISES

1. (*a*) Explain why northern China and central and western India grow millet and grain sorghum. (*b*) Why are these excellent food crops for these areas?

2. (*a*) List several reasons explaining why wheat is an important food crop for India. (*b*) Why is the wheat of China grown in the northern part?

3. (*a*) Why is barley a good crop for India? (*b*) For Japan?

4. (*a*) What other food crops are important in monsoon lands? (*b*) Can you explain why corn ranks next to rice as a food in the Philippines? (*c*) Make a list of the fruits that are grown in monsoon lands.

5. List all the conditions that explain the importance of swine and poultry in southeastern Asia.

6. Study the table of Important Agricultural Exports of Southeastern Asia. Why do not foodstuffs other than rice appear in the table?

IMPORTANT AGRICULTURAL EXPORTS OF SOUTHEASTERN ASIA
(A recent year)

| *Articles and Countries* | *Total Exports* (In pounds) | *Per Cent of World's Exports* |
|---|---|---|
| Silk | | |
| Japan | 62,260,000 | 62.6 |
| China | 16,280,000 | 16.1 |
| Korea | 3,300,000 | 3.0 |

| *Articles and Countries* | *Total Exports* (In pounds) | *Per Cent of World's Exports* |
|---|---|---|
| Jute | | |
| India | 1,398,760,000 | 96.3 |
| Manila hemp (Philippines) | 374,080,000 | 100.0 |
| Rubber | | |
| Malay States | 1,239,260,000 | 55.0 |
| Dutch East Indies | 615,120,000 | 27.3 |
| Ceylon | 181,940,000 | 8.0 |
| Other areas | 87,560,000 | 3.9 |
| Tea | | |
| India | 364,540,000 | 40.3 |
| Ceylon | 242,660,000 | 26.8 |
| Dutch East Indies | 158,400,000 | 17.4 |
| China | 92,180,000 | 10.1 |
| Japan | 21,340,000 | 2.3 |
| Formosa | 18,480,000 | 1.9 |
| Cotton | | |
| India | 1,625,800,000 | 24.0 |
| China | 109,780,000 | 1.6 |
| Rice | | |
| India | 5,866,960,000 | 38.5 |
| Indo-China | 2,255,220,000 | 14.8 |
| Siam | 2,055,460,000 | 13.5 |
| Korea | 1,540,000,000 | 10.1 |
| Formosa | 653,840,000 | 4.3 |
| Malay States | 467,280,000 | 3.6 |

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"The Ganges"—68, pp. 33–45.

"The Indus Plain"—27, pp. 287–293

"Food Crops of a Deccan Village"—B, XXX (1931), 53–56

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"Garden Cultivation"—A, IX (1933), 47–50

[8] Numbers and letters refer to Selected References on pages 420–424.

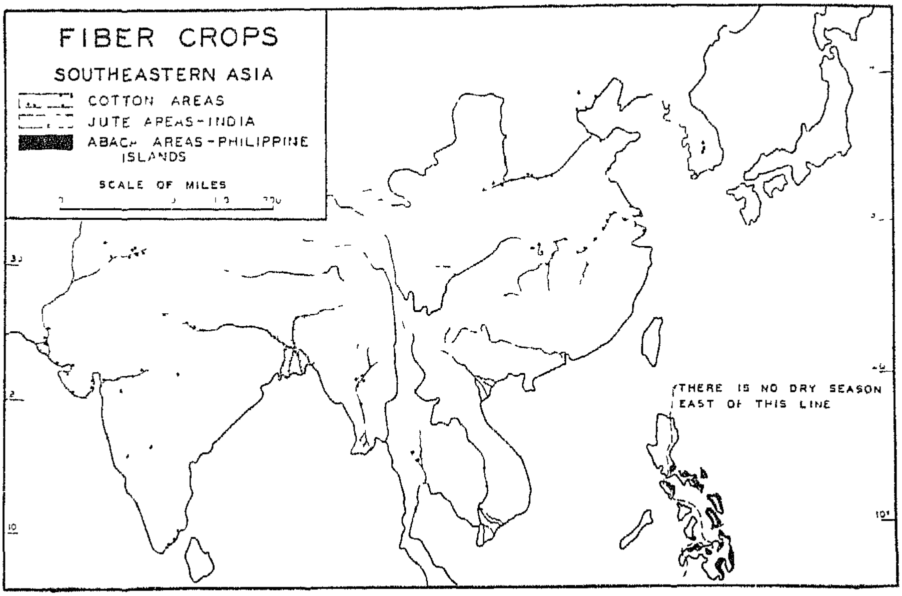



FIG. 120 What are the major cotton regions of southeastern Asia? Show the relation of rainfall to these crops (pages 132, 136, and 156)

## § IV — FIBERS IN MONSOON AGRICULTURE

Food crops of monsoon regions are very important, but these lands also produce fibers in many sections. In regions of dense population the people require much fiber for clothing, and where they eat all the food crops, fibers may be important exports. The fibers include cotton, jute, Manila hemp, and silk. Manila hemp and jute are chiefly export crops.

**Cotton.** Study Fig. 120. India and China have more than one-third of the world's cotton acreage.

In India the chief regions have fertile black soils and a light rainfall. Cotton can be grown with less rainfall than most of the food crops of India (Chart A, p. 156). What food crops are grown in the cotton region? The black clay soils absorb much moisture during the rainy season and give it up slowly to the growing cotton.

Because of the low rainfall the cotton is not so good as American long-staple cotton. However, it supplies the natives with a clothing material and furnishes one-fifth of the value of the country's exports. This short-fiber cotton goes chiefly to Japan, Italy, and Germany, countries making low-grade cotton goods.

In China cotton is grown in the fertile alluvial plains of the northern part of the country. What are the two great rivers? Here fertile soils, light rainfall, and much sunshine favor cotton, but because of the dense population most of the land must be devoted to food crops. In places cotton may be planted just before the harvest of wheat and other crops since it grows through the dry season and is harvested before the monsoon rains. Can you tell why China grows less cotton than India?

*Courtesy of Ludlow Manufacturing Associates*

PEELING JUTE

FIG 121 The preparation of the jute fiber requires much careful labor After standing a few days in the open air, the plants are tied in bundles and are submerged in pools of still, warm, clear water to ferment for ten to twenty days The small pools of water are used many times When the gummy substance around the fiber is loosened, the workers untie the bundles, beat them with a paddle, peel the fiber from the pith and bark, and wash the fibers by beating them on the surface of the water Then the fibers are dried over bamboo frames before being tied in bundles for market. What physical and economic conditions give the Ganges Delta a world monopoly of jute production?

Jute. Jute products are among the most widespread of all commodities, but one region produces all the world's supply (p 153) Jute fiber furnishes wrapping for bales of cotton, wool, and rags, it supplies bags for coffee, sugar, cement, potatoes, and many other materials, also it goes into the bases of carpets, rugs, and linoleum and is made into twine. The United States alone imports about $100,000,000 of jute products. The world's output of jute is worth more than $300,000,000 What other countries are likely to be large consumers of jute products? A large use of jute depends upon its cheapness. Many other fibers can be used for bags and wrapping, but they are more expensive.

In the Ganges-Brahmaputra delta this fiber finds almost ideal conditions (p. 154). It requires great warmth, heavy rains, a dry season, fertile soil, level land with pools of water, enormous quantities of labor, and good transportation facilities. It finds these, better than anywhere else, in the deltas of the Ganges and Brahmaputra rivers. The delta region has hot weather all the time (Chart B, p. 132). Showers come early enough to permit planting in March, giving the crop time to start before the heavy monsoon rains The jute fields are flooded by monsoon rains and water from the Ganges and Brahmaputra rivers The alluvial soil is made more fertile by annual floods Every farmer has his patch of jute The plant yields abundantly; when ripe, it covers the ground in a dense stand of finger-thick stalks, reaching a height of sixteen feet and having branches only at the top (Fig. 121).

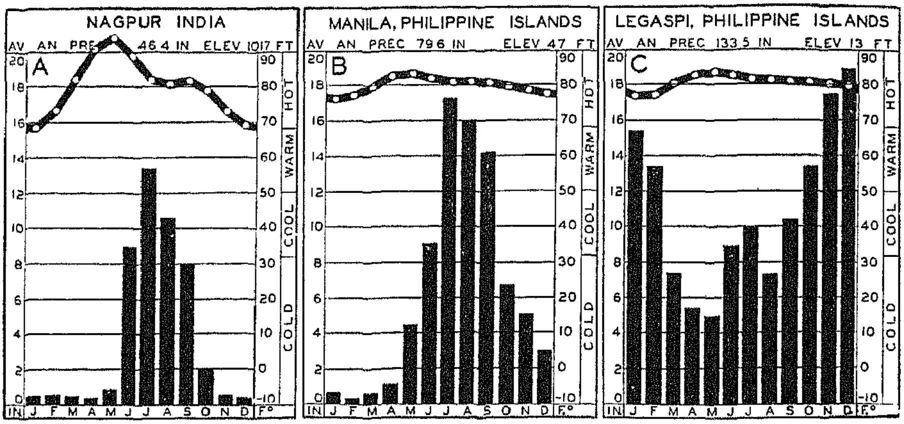
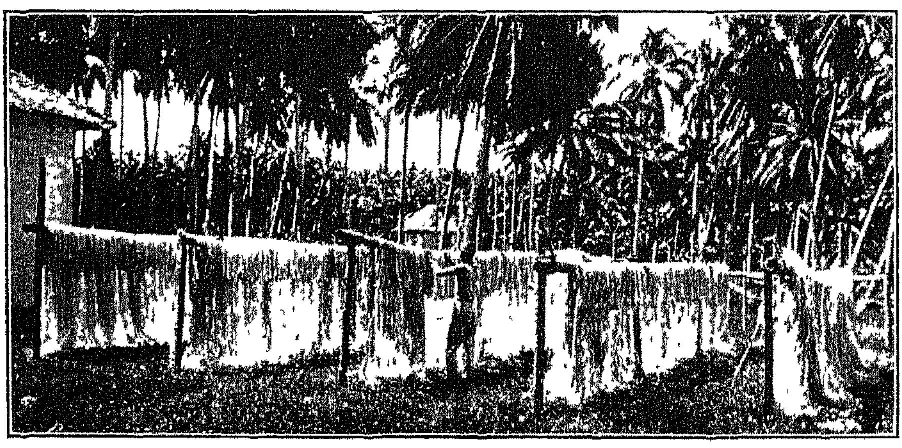



FIG 122 Chart A is a station in the cotton region of India; in what ways is cotton culture here related to climate? Contrast this chart with that of Silchar in the tea region (page 132) The climate of the jute region is very much like that of the tea region of Assam Study Charts B and C and explain why jute is not grown in the western part of the islands Compare Chart C with Chart B (page 109)

Harvesting and preparing for market require much labor. The crop is cut with a hand sickle Then bundles of stems are thrown into pools of water and left several days until the gum surrounding the fiber ferments and can be washed out. Flat deltaic plains afford an excellent type of land for this work The farmers beat the stalks in water to loosen the fibers which they wash and dry. To obtain one hundred pounds of fiber the farmers handle a ton of jute This gives an idea of how hard they work in spite of great heat

From the farm the jute goes by river to the huge mills and warehouses at Calcutta, where this fiber has given India its second most important manufacturing industry. About half of the crop is used in the Calcutta mills which send gunny cloth and gunny



*Courtesy of Philippine Bureau of Science*

FIG 123 ABACA (HEMP) DRYING, MINDANAO, PHILIPPINE ISLANDS

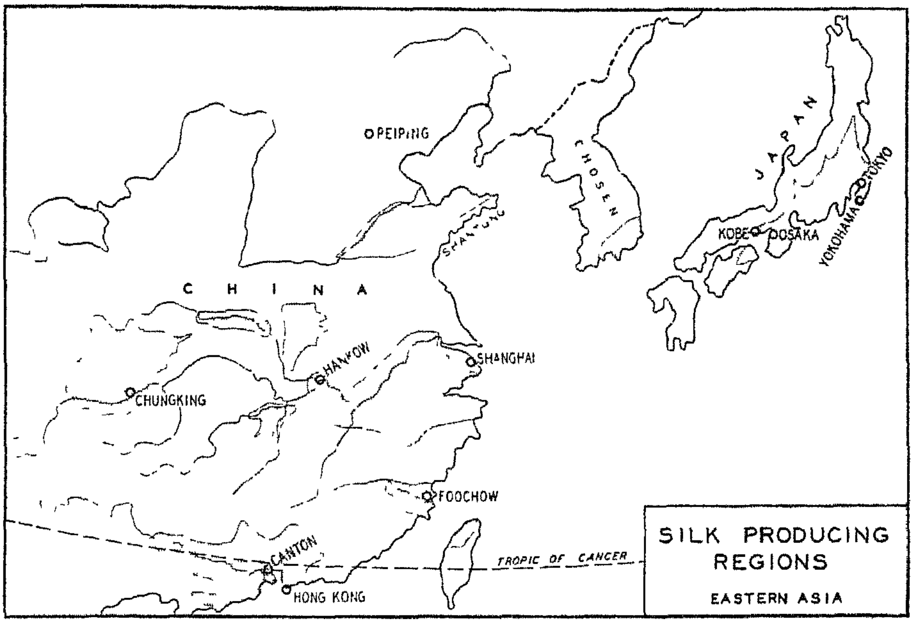


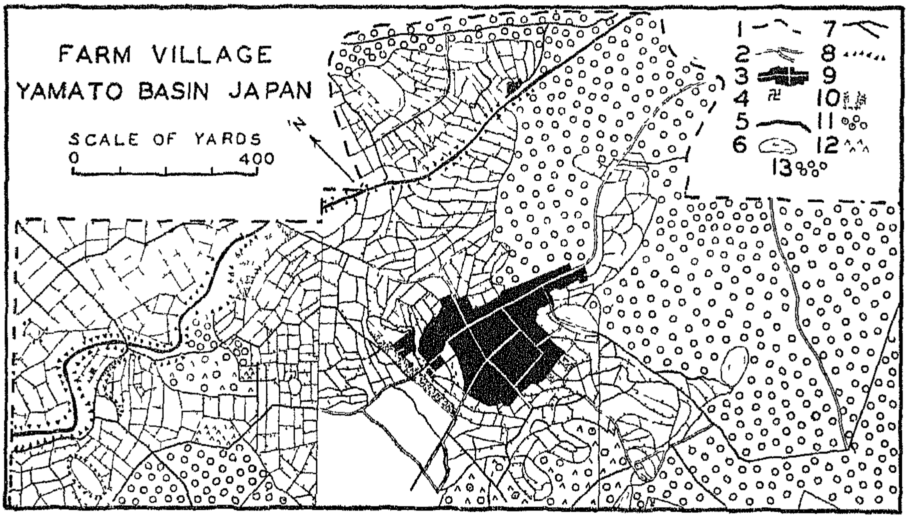

FIG 124 The mulberry tree is grown on what type of land? In what other ways are hill lands used (page 158)?

bags all over the world The rest of the crop is exported, chiefly to Scotland where there are large jute manufacturing plants at Dundee

**Manila Hemp.** Manila hemp is almost as important to the Philippine Islands as jute is to India This fiber, which makes the finest rope, is practically a monopoly of the Philippines (p. 153). It takes its name from the port through which it is shipped. In contrast to jute, the cheapest of fibers, Manila hemp is expensive. It is the most valuable of cordage fibers It is lighter, longer, stronger, and more durable than other rope fibers Why are the United States and the United Kingdom the leading buyers of Manila hemp?

Abaca, the Manila hemp tree, resembles the banana plant and grows in the same type of environment. The stalk contains the fibers, which may be as much as eight feet long. Review the physical conditions for the growth of bananas (p. 115)

Many areas with the banana climate could grow abaca, but none of them produces the fiber (Fig. 122). Filipinos have used abaca fibers for a long time in mats, bags, slippers, hats, and even in cloth mixed with silk They have the knowledge of how to grow the abaca and extract the fiber and pass their knowledge down from one generation to another. Attempts to teach other peoples have not been successful Extracting the fiber or "stripping," as it is called, is a difficult task, only a skilled stripper can get high-grade Manila hemp (Fig. 123) The plant does so well on the fertile volcanic soils of the eastern part of the islands where there is no marked dry season that it occupies one-eighth of the entire cultivated area of the Philippines and is the third most important export (p. 154).




*After map by Robert Burnett Hall*

A Farm Village, Yamato Basin, Japan

Fig 125 1, Boundary 2, Narrow roads 3, Houses in the village 4, Cemetery 5, River 6, Irrigation and fish ponds 7, Ditch or canal 8, High embankment 9, Paddy rice 10, Dry cereal. 11, Fruit trees 12, Tea 13, Woods

This farm village is on the eastern edge of the Yamato Basin (compare with Fig 108). The alluvial plain grows rice in the summer and dry cereals in the winter Mulberry, pear and persimmon orchards and tea and vegetable gardens are on the upper parts of the alluvial plains and lower parts of the hills The hills are wooded The woods of the hills protect the rice lands from too heavy floods They also provide wood for charcoal (a cheap fuel), for furniture, for spindles in the cotton mills, for poles for drying rice, wheat, and barley, and for chopsticks

**Silk.** The silk industry of Japan and China is an excellent illustration of the utilization of resources by a densely populated country. How many major silk-producing areas does eastern Asia have (Fig 124)? Each of these has a climate favoring the growth of a leaf crop for feed for silkworms and a dense population supplying labor. Several conditions favor the silk industry of eastern Asia

In the silk-producing districts of Japan and China the long growing season and summer rains cause the mulberry tree to yield in a year two hundred pounds of tender leaves. Under these conditions in Japan the tree yields a second and third crop of leaves for feeding the summer and autumn breeds of worms. For this reason, Japan exports three crops of

*Courtesy of Kaoru Tanaka*

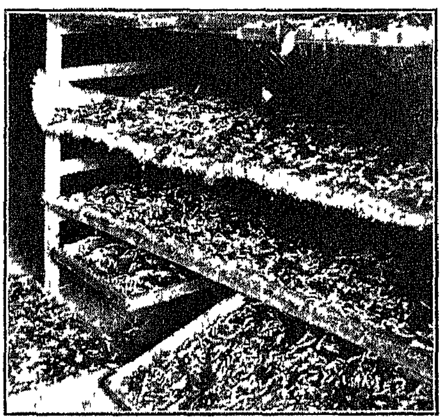
Fig. 126 Carrying Mulberry Leaves Home to Feed the Silkworms

*Courtesy of Kaoru Tanaka*

FIG 127 CHOPPING LEAVES AND FEEDING SILKWORMS

silk In the southernmost area in China trees produce feed for seven or eight broods of worms in one season In Shantung, the northern area in China, silkworms are fed on oak leaves from which only one major crop is produced. Because the worms are very delicate, the moist air and even temperatures of these regions favor the industry

Like the tea bushes of China and Japan, mulberry bushes are grown on rough land not suited to rice and other food crops Also, mulberry trees may be scattered in unirrigated



*Courtesy of Kaoru Tanaka*

FIG. 128. SILKWORMS FEEDING ON MULBERRY LEAVES

fields of barley, beans, and upland rice (Fig 125) The trees are so closely clipped for the leaves to feed the worms that they do not cast enough shade to harm these crops.

Only regions of dense population have sufficient labor to carry on the breeding of silkworms (Fig 126). The labor also must be skilled (Fig. 127) For generations the parents of the silk regions have taught children the care of silkworms and how to spin the fiber, reel silk, and weave it into

*Courtesy of Wallace W Atwood*

FIG 129 REELING SILK FROM THE COCOONS

cloth Nearly five million families carry on this work in Japan and China, two-fifths of the farmers of Japan are thus employed. Much work is required in caring for the worms for four or five weeks from the hatching of the eggs until the spinning of the cocoons (Fig 128). The worms have to be fed carefully several times every day, the worms feed twice during the night. For every pound of silk produced one hundred fifty pounds of leaves are gathered and fed to the worms, and each pound of silk re-

quires the cocoons of more than twenty-five hundred worms

In summer and autumn women and children spend days and weeks sorting cocoons, twisting into a single thread the filaments from four or more cocoons, and reeling the silk into skeins (Fig 129) So much work is required in reeling silk that many reeling mills have been set up in Japan and China Manufacturers prefer silk reeled by machinery

Silkworm culture distributes work through the year This is important in densely settled regions If a family raises three broods per year this work extends through six months, then the preparation of the silk from the cocoons takes the time of the women and children for the remainder of the year (see Fig 322). In this way most members of the family are employed.

We have learned that most of the food crops of southeastern Asia are consumed at home In contrast, silk is a leading cash crop and export article Conducted as a household industry, the culture of silkworms provides a small cash income for the rural people whose farms are gardens For many families silk is the only cash crop

In both of these countries the government greatly aids the industry, but especially in Japan There through scientific methods the yield of silk per ounce of eggs has been doubled by eliminating silkworm diseases The government distributes disease-free eggs It has established schools to train experts who go into the silk districts to teach better methods to the farmers It has passed laws to prevent the exportation of poor quality silk

## EXERCISES

THE PLACES OF LEADING AGRICULTURAL COMMODITIES IN THE EXPORTS OF THE COUNTRIES OF SOUTHEASTERN ASIA

(A recent year)

| *Country and Commodity* | *Value of all Exports of each country* | *Value of Exports of commodity* | *% of Total Exports of each country* |
|---|---|---|---|
| India | $919,111,000 | | |
| Cotton | | $199,213,000 | 21.6 |
| Jute | | 193,284,000 | 21.0 |
| Rice | | 117,732,000 | 12.8 |
| Tea | | 85,538,000 | 9.2 |
| Japan | 708,571,000 | | |
| Silk | | 205,782,000 | 29.0 |
| Tea | | 4,143,000 | .5 |
| Dutch East Indies | 480,685,000 | | |
| Rubber | | 68,695,000 | 14.3 |
| Tea | | 27,952,000 | 5.8 |
| China | 411,628,000 | | |
| Silk | | 48,553,000 | 11.8 |
| Cotton | | 12,190,000 | 2.9 |
| Tea | | 12,091,000 | 2.9 |

| Country and Commodity | Value of all Exports of each country | Value of Exports of commodity | % of Total Exports of each country |
|---|---|---|---|
| Malay States .. | 377,228,000 | | |
| Rubber | | 136,849,000 | 36.3 |
| Rice | | 12 934,000 | 3 4 |
| Philippine Islands | 132,304,000 | | |
| Manila hemp | | 18,427,000 | 13 9 |

1 (*a*) Make a list of as many as you can of the commodities that are shipped in burlap or jute bags (*b*) What percentage of the world's jute does India produce? (*c*) What conditions make this possible? (*d*) Is jute an important export of India? (*e*) What other commodity makes up about the same per cent of India's exports?

2. (*a*) What percentage of the Manila hemp of the world do the Philippines produce? (*b*) What conditions favor this? (*c*) Is it an important export of the Philippines?

3 (*a*) Show how silk production in Japan is related to the physical conditions, to other crops, to the population (*b*) Is silk an important export of Japan? (*c*) What percentage of the world's exports of silk does southeastern Asia ship?

4 Products of monsoon agriculture make up two-thirds of the exports of India (*a*) What are they? (*b*) Why are farm products so important in the exports of monsoon lands?

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"Cotton Lands and the Plateau" — **27,** pp. 294–299, **12,** pp. 475–478, **A,** IX (1933), 127–129

"Jute Production" — **12,** pp 479–481, **7,** IV, pp 322–324, **39,** pp. 1–12, **29;** **A,** IX (1933), 131, **4,** 211–217

"The Manila Hemp Industry" — **B,** XXVI (1927), 47–48, **4,** pp 231–237, **80,** pp 86–92, 126–127, **12,** pp. 431–436, **29; 63,** pp. 143–147.

"A Survey of the Silk Industry" — **B,** XXVI (1927), 220–229, **25,** III, pp 92–101, **56; 4,** pp 258–267, **37; A,** XI (1935), 105–107

## TOPICS FOR INVESTIGATION AND REPORT

"Delta Homes and Farms" — **27,** pp 257–263

"History of Silk Raising" — **7,** IV, 180–183, **56,** pp 7–8, **10,** Chapter XIV

"Cultivating the Mulberry Trees" — **18,** Chapter XIII.

"The Growth of Silkworms" — **27,** pp 65–68, 179–182; **7,** IV, pp 92–96, **2,** V, pp 413–419, **56,** pp 9–12; **4,** pp 258–267, **10,** Chapter XV.

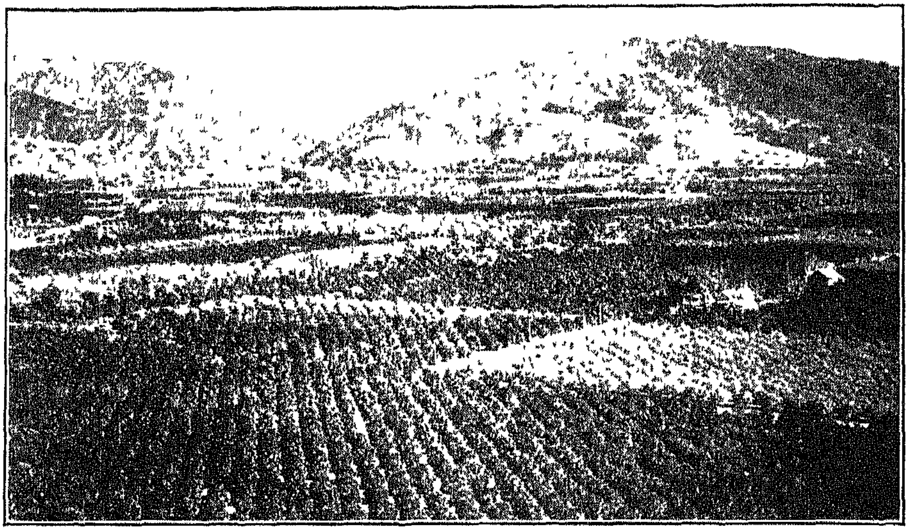
"Silk Manufacture" — **27,** pp. 68–75; **2,** V, pp 419–421, **56,** pp 12–17, **4,** pp 267–281

"Why Japan Leads in the Export of Silk" — **12,** pp. 423–427.

"A Silk District in Japan" — **J,** XX (1930), 237–244.

"Japan's Artificial Silk Industry" — **A,** XI (1935), 105–107

[1] Numbers and letters refer to Selected References on pages 420–424



Sunkist Photo

CITRUS ORCHARDS, GLENDORA, CALIFORNIA

FIG 130 Several features favor Mediterranean agriculture here List them Notice the snow on the mountain peak

# CHAPTER XV

# FARMING IN REGIONS OF MEDITERRANEAN CLIMATE

## § I — CHIEF CHARACTERISTICS OF MEDITERRANEAN AGRICULTURE

Farming in regions of the Mediterranean type of climate exhibits many similarities to farming in monsoon lands, but the contrasts are more striking and significant. Both have decided rainy and dry seasons. Both have intensive types of agriculture. Both have dense populations in certain areas But the rains in monsoon lands far exceed those of Mediterranean lands; the rains in Mediterranean lands come chiefly in winter (p 164). In the former area intensiveness is due chiefly to dense population; in the latter to the small area of arable land. The dense population of monsoon regions covers vast areas, but in Mediterranean lands it concentrates in a few choice spots (Fig 130) Much rugged land leaves only small valleys and plains for farming in Mediterranean climates, and animals find an important place.

Each continent has an area of Mediterranean climate. The most extensive is that about the sea common to Europe, Asia, and Africa, from which the climate is named. In North America, the type applies to central and southern California, in South America to middle Chile, in south Africa to an area about Cape Town, in Australia to the southwestern tip. In each continent the areas with the warmth, winter rainfall, and summer drought of such a climate form sharp contrasts to other regions

The climate, fertile alluvial soils,

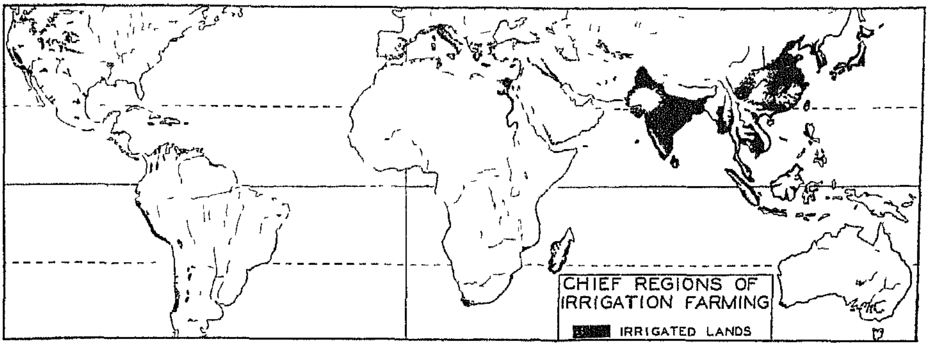
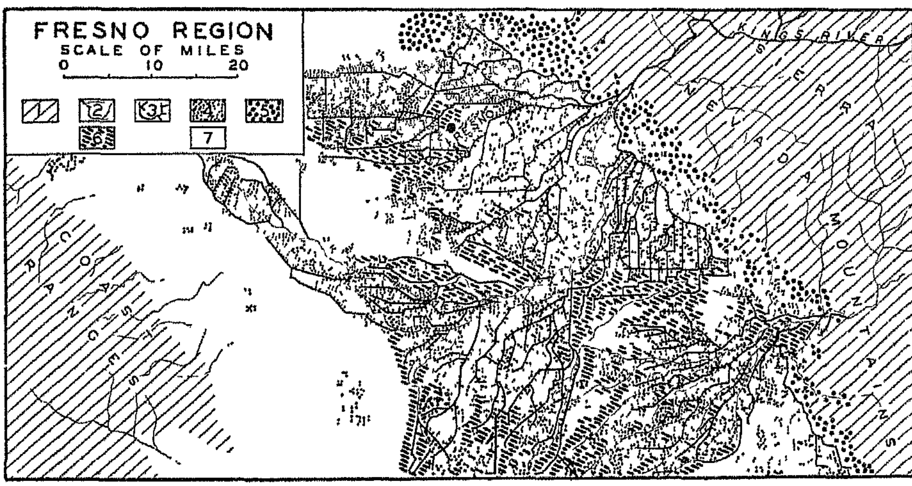



FIG 131 Areas of Mediterranean climates, arid regions, and monsoon lands have most of the irrigated lands of the world Make a list of the crops that are irrigated in monsoon regions In regions of Mediterranean climate

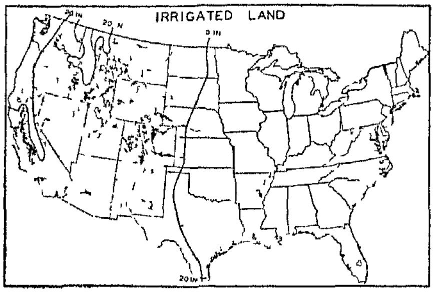
and the hill lands provide bases for three types of agricultural activity (1) irrigation farming on the lower slopes and plains, (2) general farming on the slopes with more rainfall, and (3) grazing in the mountains on the drier lands and in irrigated pastures These types of activity produce a variety of products for home use and many for export. Think of California oranges, lemons, grapefruit, raisins, and figs. If you lived in England you would think of Spanish oranges, Sicilian lemons, Italian wines, Spanish raisins, Greek currants, and Turkish (Smyrna) figs.




A REGION OF MEDITERRANEAN AGRICULTURE

FIG 132. 1, Mountains, Sierra Nevada on the east and coast ranges on the west. 2, Rivers 3, Irrigation canals 4, Irrigated orchard and garden lands 5, Foothill agricultural lands 6, Irrigated pastures. 7, Valley pasture, wheat and barley lands How broad is the valley from the coast ranges to the Sierra Nevadas? The chief irrigated area? About how long is the longest canal you can find on the map? Why does the Kings River diminish and finally disappear on the plain? Show how the surface of the land favors irrigation Where does the water come from for the patches of irrigated land near the coast ranges? For what purpose is the land around these patches (the white area) used? Many sheep are kept in this region (page 96). Where do they graze in summer? In winter?

Without irrigation these lands could support few people. Many conditions in areas of Mediterranean climate favor irrigation. Study the areas of irrigation in Figs. 131, 132, and 133. Figure 132 shows an important irri-




After United States Department of Agriculture

FIG. 133. What relation exists between irrigated land and twenty inches annual rainfall? The irrigated areas in Arkansas and Louisiana are rice lands.

gated district of California. This area has the characteristics of a Mediterranean climate. The amount of precipitation is less than ten inches (Fig. 134), and takes place principally in the winter, falling largely on the highlands in the form of snow. This melts slowly during the spring and summer and flows in many streams down the mountains onto the piedmont plains and valley floors. The highest peaks retain caps of snow throughout the summer. Notice that the rivers of the mountains become smaller or even disappear in the plains. The water escapes in three ways: some of it evaporates in the hot days, some is diverted into irrigation canals, and some sinks into the loose soil, sand, and gravel of the piedmont plains and valley floors. Loose materials hold water like a sponge, so that many pumps may lift water from shallow wells dug in the sandy plain. The surface has a new film of soil added by each application of irrigation water. High temperatures of the long growing season, much sunshine, and dry air are especially favorable for the growth and preparation of a variety of fruits, vegetables, and grains.

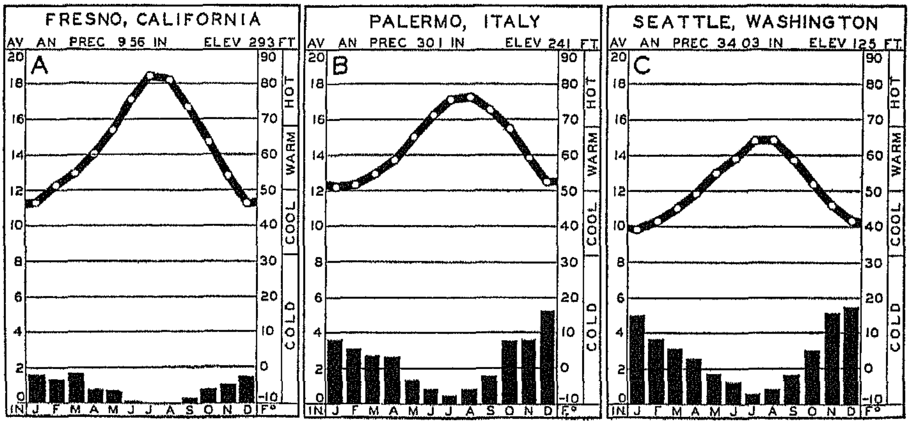



FIG. 134. Light winter rains, summer droughts, long hot summers, and mild winters are characteristic of Mediterranean climate. Contrast the temperature and rainfall of Chart A with those of Chart C, page 136. Many districts in regions of Mediterranean climate get more rain than Fresno, as does Palermo, Italy.

## EXERCISES

1. (*a*) From the rainfall maps and charts list the chief characteristics of the Mediterranean climate. (*b*) Why do many people go to California for a

winter vacation? (c) From northern Europe to southern Europe?

2 (a) List the areas that have the Mediterranean type of climate (b) What three types of agricultural activity do we find in regions of Mediterranean climate?

3 Complete the lists and answer the questions under Figs 131 and 132

4 (a) List all the conditions that favor irrigation farming in the Fresno region (b) Do the irrigated lands comprise a large or small part of the region? (c) Why?

## AN EXTRA LESSON

"The Significance of Irrigation" — 16, pp. 361–374.

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"Mediterranean Agriculture in Europe" — 7, III, pp 427–431, 462–468, A, II (1926), 86–95

"Mediterranean Crops Region of Chile" — A, IV (1928), 267–272, or 17, pp 137–142

"Fruits Grown in Regions of Mediterranean Climate" — 13, pp 91–107, 116–118

"Character of Agriculture in California" — A, VI (1930), 294–299

"Irrigation in the Mediterranean Region" — B, XXIX (1930), 121–128, A, IV (1928), 296–304

"Irrigation in Los Angeles District" — 12, pp 186–189, A, X (1934), 56, 59–62, 66–69.

# § II — THE FRESNO REGION: AN EXAMPLE OF MEDITERRANEAN AGRICULTURE

The many conditions that favor irrigation in regions of Mediterranean climate make possible the production of a great variety of fruits and vegetables not only for home use but also for export. Let us see how these conditions are related to the culture of grapes and other fruits

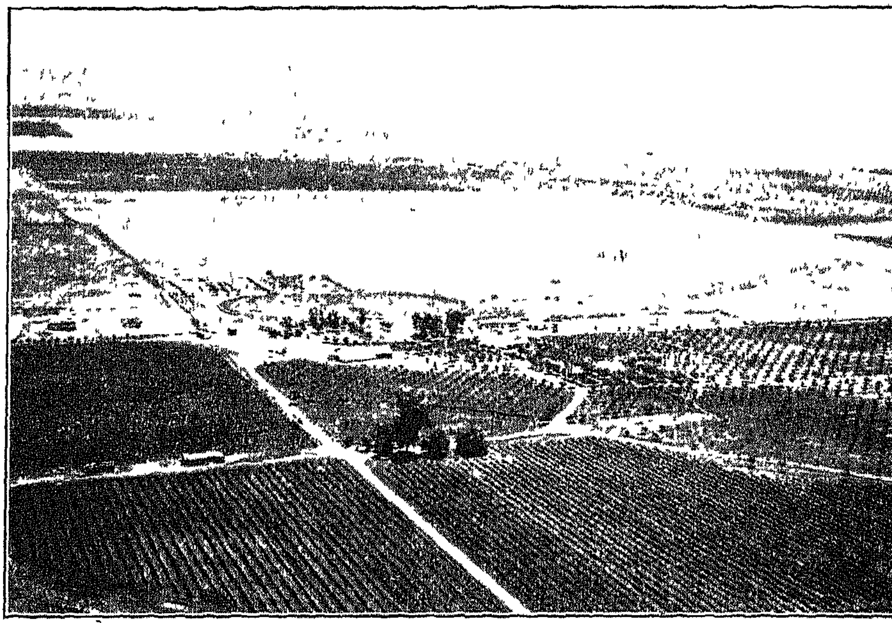
## RAISIN-GROWERS IN THE FRESNO, CALIFORNIA, REGION

Much of the irrigated land in the Fresno region grows grapes, but some produces peaches, other fruits, vegetables, wheat, and grasses for pasturage (Fig. 135) In regions practically free from frosts, citrus fruits become more important. Several conditions favor raisin growers in regions of Mediterranean climate (Fig. 136)

**Surface and Soils.** The surface of this plain is made up of fine sandy loam materials resting on sands and gravels of considerable depth The loose fertile soils are easy to cultivate. Water soaks into them readily and reaches the roots of the vines that may grow down twenty feet or more, making it possible for grapes to live in hot dry weather. Several different types of soils grow different varieties of grapes.

**The Cool Winter.** During the winter the vines are leafless and dormant. Then they do not require irrigation. At intervals during winter frosts occur, but they do not injure the vines unless the temperature falls below 20 degrees Fahrenheit. Temperatures as low as that seldom occur. The real danger from frost comes in spring after the buds appear, but only once in ten years do spring frosts greatly reduce the crop In late winter the vines are

[1] Numbers and letters refer to Selected References on pages 420–424



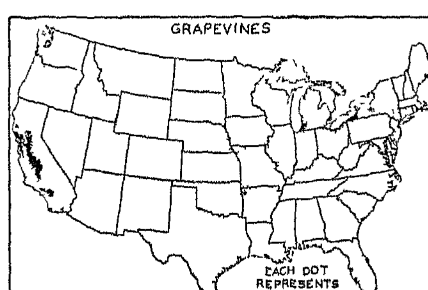
*Courtesy of Fresno Chamber of Commerce*

HARRY BALFE RANCH, NEAR FRESNO

FIG 135. In the foreground are extensive vineyards; in the center peach, fig, and apricot orchards, beyond, pasture, grain land and more vineyards, orchards and grain land extend to the foot of the Sierra Nevadas Palm and date trees surround the residence

pruned and the ground plowed; late winter pruning reduces the frost hazard because the buds that would open first are cut off. Winter plowing conserves winter rains At this season heavy snows fall in the high mountains.

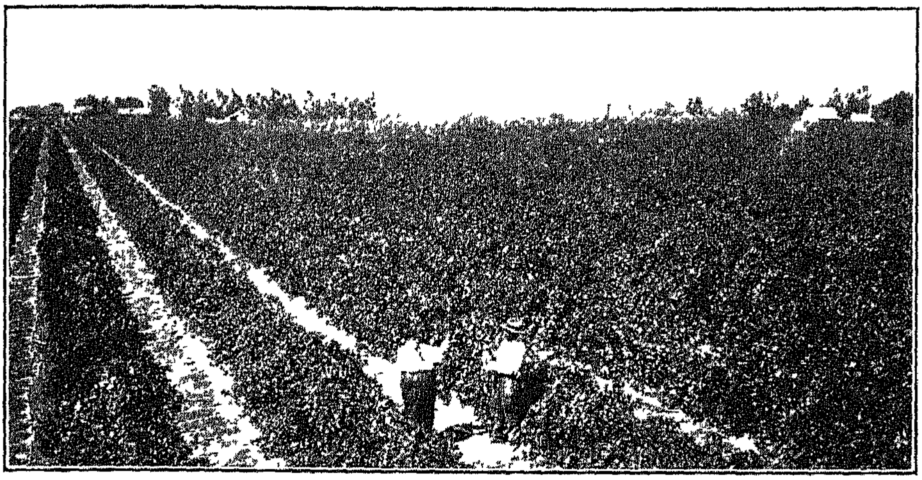
**The Long Hot Dry Summer.** Early in spring the ground is still wet from winter rains When the buds appear in April, irrigation begins The vines need only two or three irrigations because the plant gets much water through its roots deep in the soils and the plant produces better grapes when it doesn't get too much water. Beginning in April the vines are cultivated three or four times and hoed once or twice in June to keep down all weeds and to keep the soil loose. Hot sunny weather makes grapes grow rapidly, melting snows in the mountains release ample water The season has no thunderstorms, hailstorms, and violent winds to damage the grapes




*Courtesy of United States Department of Agriculture*

GRAPE REGIONS OF THE UNITED STATES

FIG 136. California produces nearly nine-tenths of the grapes of the United States. Why are there grape districts on the margin of the Great Lakes? How are these grapes used?



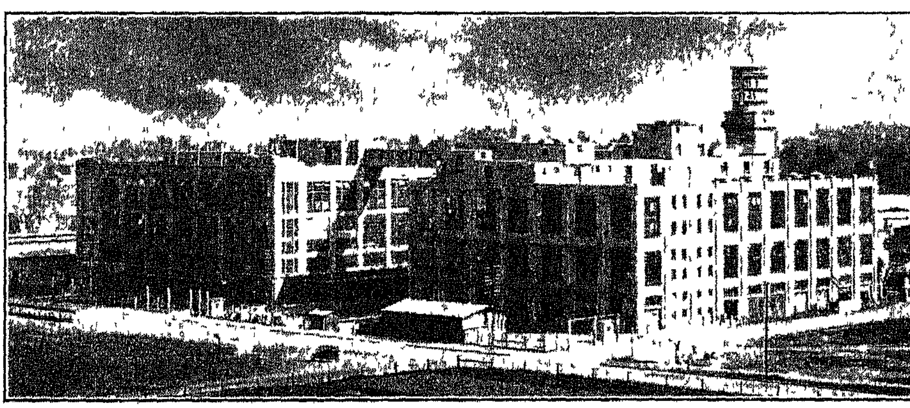
*Courtesy of Sun-Maid Raisin Growers Association*

FIG 137 RAISINS DRYING IN THE SUN BETWEEN ROWS OF VINES

After late July no more water is turned on the fields. The ripening-curing season extends from early August to the last of October To ripen and store up sugar properly the grape needs in this season high temperatures, much sunshine, and dry air.

During July, August, and September the region gets about 90 per cent of the possible sunshine. Temperatures are high The air is especially dry, even a piece of tissue paper lying out all night will be dry and crisp in the morning. Almost no rains occur during the ripening period The Fresno weather record of forty-three seasons shows for August a rainfall figure for only three years, a trace for thirteen years, and no rain for twenty-seven years. Rains at this season are bad. Rains cause the vines to grow leaves and not ripen the grapes; they reduce the sugar content, grapes to make good raisins must contain at least 22 per cent sugar.

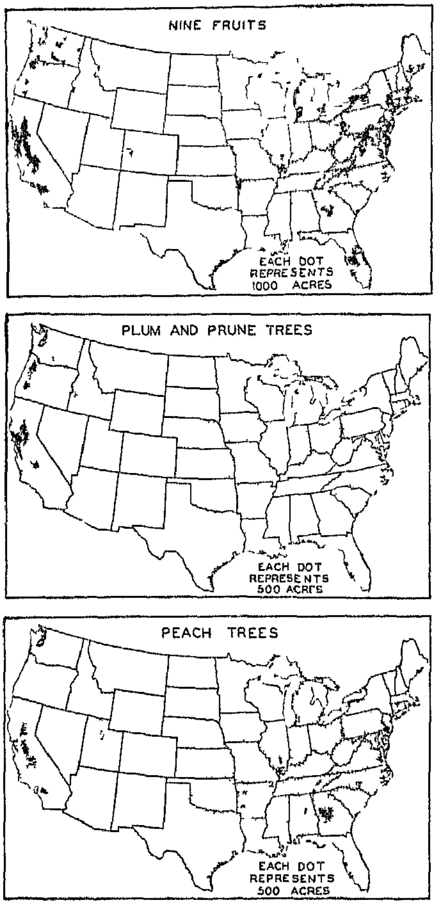
Picking begins about August 20 and



*Courtesy of Fresno County Chamber of Commerce*

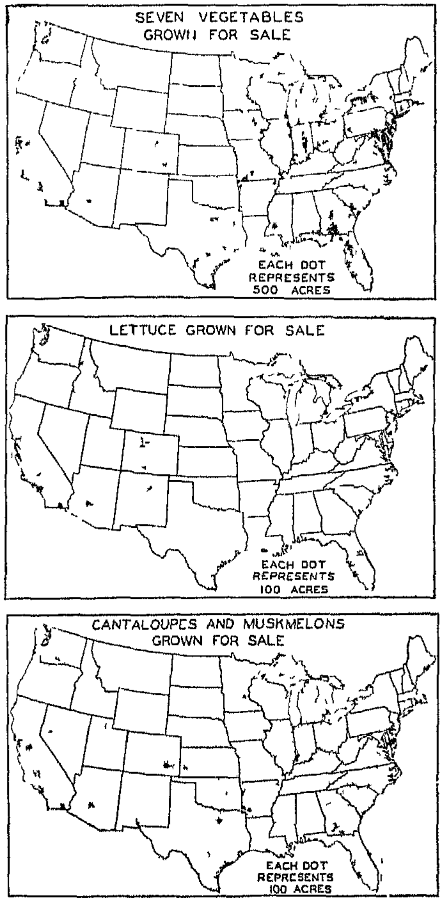
SUN-MAID PACKING PLANT

FIG. 138. This plant at Fresno is the largest dried-fruit packing plant in the world.




*Courtesy of United States Department of Agriculture*

FIG. 139. The nine fruits included in the first map are grapes, oranges, lemons, grapefruit, plums and prunes, pears, peaches, apples, and strawberries. The Mediterranean region of California has two of the great fruit regions of the nation. What conditions favor the production of nearly all the plums and prunes in western United States? List the important peach districts. How are the peaches of California marketed?




*Courtesy of United States Department of Agriculture*

FIG. 140. Many districts produce cabbage, cantaloupes, lettuce, onions, sweet corn, tomatoes, and watermelons for sale. When are those of southern Texas marketed? Lettuce and cantaloupes are two important winter season crops for southern California. List the conditions that favor their production during the winter season. When are the cantaloupes of southern Georgia and Texas marketed?

by September 15 most of the grapes are on the trays (Fig. 137). The picking season is a busy one. To make good raisins the grapes must be picked when the sugar content is just right. Japanese, Mexican, and Italian laborers and others flock to the region to get high wages during the picking season. The grapes are cured on trays placed between the rows. The drying weather of September and October has clear days, bright sunshine, dry air, and light and infrequent rains. When the grapes become a purplish brown on one side, they are turned over; when that side is dry, the trays

are stacked It takes three weeks to cure grapes. Even small rains during this time cause much trouble or damage The weather is watched carefully, if rain is forecasted, the farmers hurriedly pack the trays and cover them, for a big rain might spoil the entire crop. But the Fresno region has an almost perfect drying season, a rainy period coming only once in about nine years.

Sunkist Photo

ORCHARD OIL-BURNERS NEAR LOS ANGELES

FIG 141 Oil-burning heaters keep fruit and trees from frost injury on cold winter nights How long is the growing season at Fresno?

**Diseases and Pests.** Another advantage of the Fresno region, and other regions with Mediterranean climate, for grape culture is their relative freedom from diseases and pests. Dry sunny weather, new soils, and proper irrigation in the Fresno region reduce the damage caused by phylloxera, vine disease, mealy bug, mildew, and black scale. Damp cool weather would favor these diseases and pests. Varieties of vines free from phylloxera are being produced by grafting. Mildew must be stopped by sprinkling dry sulphur on the vines after rains. The black scale is killed by the dry air and temperatures of 106 degrees Fahrenheit for several days; most grape regions do not have temperatures this high.

**Cooperative Marketing.** Most of the raisins produced in the Fresno region are consumed three thousand or more miles away (Fig 138) At first thought this might appear as a big handicap, but it has really worked to the advantage of the raisin producers It caused the organization of the Sun-Maid Raisin Growers Association This association controls nearly all the raisin acreage in California, it has standardized methods of growing, picking, and curing grapes, it created and widely advertised its trade mark "Sun-Maid," registered in more than fifty countries and worth millions of dollars, it extended sales organizations into the chief market regions. The leading market area is northeastern United States and eastern Canada, but thousands of tons go to northwest Europe and even to Japan.

## OTHER FRUITS AND VEGETABLES IN THE FRESNO REGION

In addition to raisins, this region dries and ships prunes, peaches, and apricots, it ships canned peaches, berries, asparagus, peas, tomatoes, and many others; it ships strawberries, tomatoes, cantaloupes, and other fruits and vegetables to winter and spring markets in eastern United States (Fig. 139). The same conditions that favor raisin culture favor the other fruits and vegetables (Fig. 140). Growing a variety of products, some of which are winter crops, distributes the labor over a large part of the year.

The citrus fruit and fig regions are farther south where there is less danger from frost (Fig. 141). The

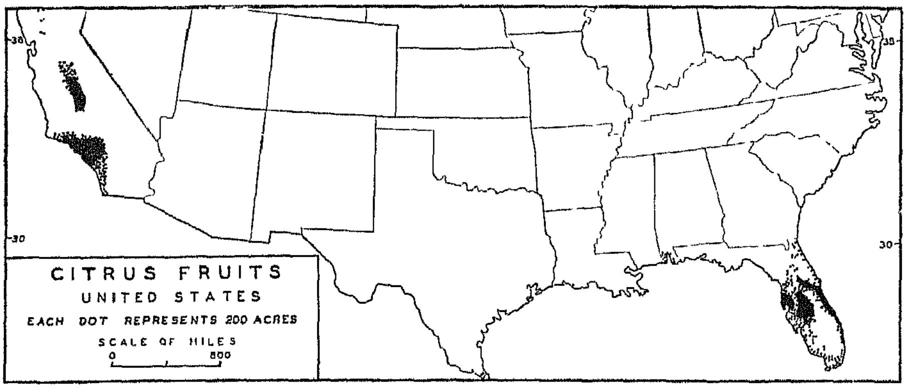



FIG 142 Citrus fruit production in the United States is confined chiefly to three areas List the conditions that favor citrus culture in the Mediterranean region of southern California, refer to text and pictures

mountains to the north of Los Angeles protect the citrus orchards from cold waves that come south as far as the Fresno region (Fig. 142).

Near Fresno much of the floor of the valley to the west of the irrigated lands is used for agriculture (pp 65 and 180). These areas have some large wheat and barley farms. The small amount of rain, winter rains, hot dry summer, and level land favor these crops But most of this area is grazing land for cattle and sheep. There are irrigated pastures where cattle are kept in summer Where are many of the sheep in the middle of the summer at the time the valley lands are very dry (p. 96)?

## EXERCISES

1. Review the conditions that favor irrigation in regions of Mediterranean climate.

2 List seven or more conditions that make raisin production important in the Fresno region

3 Study the table of raisin exports. (*a*) What percentage of the world's exports are shipped from Spain? (*b*) From the United States? (*c*) From Australia?

4. (*a*) Make three lists of the products grown in and shipped from southern California· (1) fresh, (2) dried, and (3) canned. (*b*) Why is this area one of the important sheep regions of the United States?

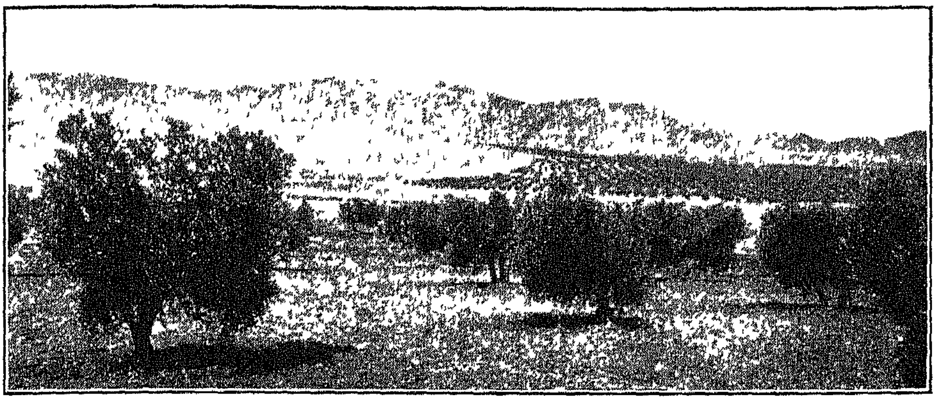
5. Make a percentage chart of raisin exports, starting with Greece, at the top of the circle.

RAISIN EXPORTS
(A recent year)

| *Countries* | *Exports in pounds* | *% of world total* |
|---|---|---|
| World total | 581,195,000 | |
| Greece | 190,426,000 | 32.7 |
| United States | 149,872,000 | |
| Australia | 89,262,000 | |
| Turkey | 87,719,000 | 15.1 |
| Spain | 23,138,000 | |
| Cyprus | 11,461,000 | 1.8 |
| All Others | | 5.7 |

## AN EXTRA LESSON

"Citrus Fruit Production in California" — 12, pp. 184–193; A, IX (1933), 337–355; 52, pp. 1–28; A, X (1934), 53–73.



Courtesy of Wallace W Atwood, Jr

FIG 143 Olive orchards, Spain Olive orchards extend for miles along the slope of the valley, the higher hillsides are used for crops and pasture, the land between the trees grows wheat, barley, or vegetables

## READINGS[2]

"Regions of Mediterranean Climate and Dried Fruits" — 24, pp 417–421, 425–427, 1, pp. 200–206, 2, I, pp. 92–106

"Orange Groves of Southern California" — 1, pp 190–196; 52, pp. 1–16.

"The Date Palm" — L, I (April, 1932), 13–18

"Grape Culture in a Desert Region — Mendoza, Argentina" — 17, pp. 350–356

"The California Fruit Industry" — A, IX (1933), 337–355

## TOPICS FOR INVESTIGATION AND REPORT

"The Value of Dried Fruits" — 13, pp. 341–350.

"California Dried Fruits" — 13, pp. 347–357; 1, pp 200–206.

"A Year's Work on an Orange Ranch" — 1, pp. 190–196.

"Protecting the Citrus Groves from Frost" — 12, pp 188–190.

"Marketing Citrus Fruits" — 12, pp. 191–192, A, IX (1933), 346 ff.

"Apiculture" — 13, pp. 187–192; J, XXII (1932), 260–270.

"Fruits and Nuts of California" — A, VI (1930), 278–288, 1, pp. 190–196, 200–206; 12, pp. 191–192.

"Pasture and Animals in Southern California" — A, VI (1930), 288–294, 296–298.

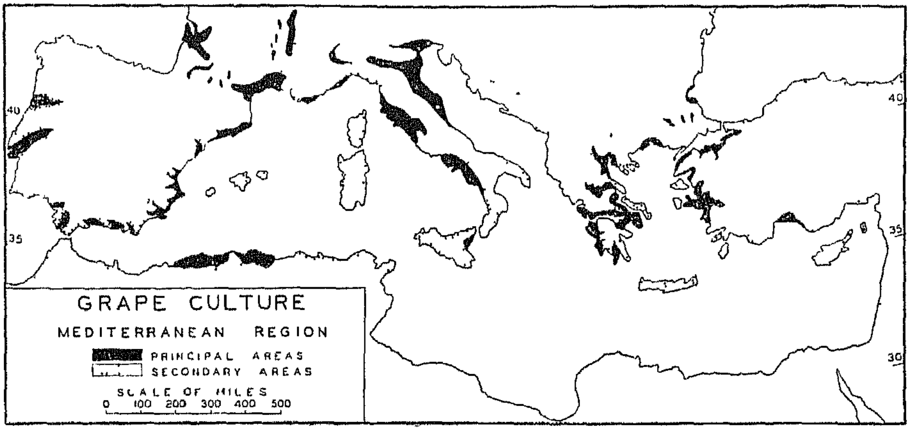
"Citrus Fruit Industry of Los Angeles Basin" — A, X (1934), 53–73.

## § III — FARMING IN THE MEDITERRANEAN REGION

Like southern California, the Mediterranean region of Eurasia and Africa produces many products closely related to the climate (Fig. 143).

**Grapes.** The vine holds a leading rank. In Italy nearly one-third of the population depends upon the vine for a living. It occupies ten million acres in this one country, only wheat exceeds it in acreage. Wherever possible the Italians grow vines; four-fifths of the total grows with other crops. Most of the grapes are used for wine; the Italians use twenty gal-

[2] Numbers and letters refer to Selected References on pages 420–424.



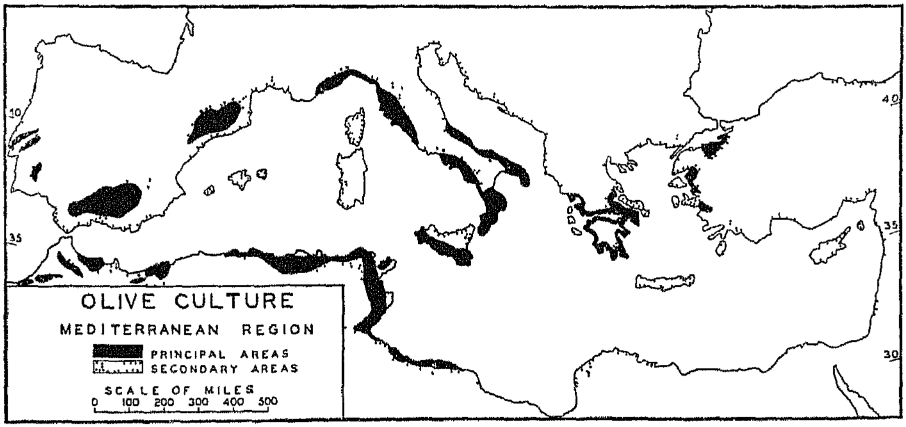
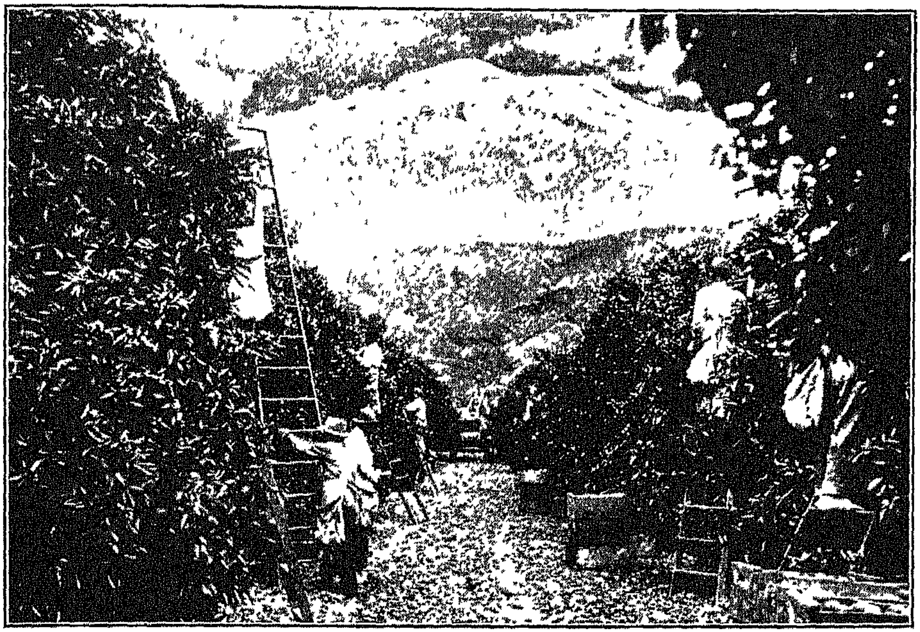




FIG 144 Grape and olive areas in Mediterranean region List separately the ways in which these crops are adapted to this region. Why are there few olives and grapes in the plateau of Asia Minor? In northern Spain?

lons of wine per person per year. What other areas produce grapes (Fig. 144)?

**Olives.** The olive tree is the most distinctive feature of old-world Mediterranean agriculture It is grown in all other Mediterranean regions but to a less extent. It is one of the most useful of all plants. The crooked gnarled trees cannot stand severe freezing, but they can endure long droughts and grow on rough land. The roots spread out near the surface and use the light rains, thick leaves prevent evaporation of moisture. Trees yield crops for a person's lifetime. Green and ripe olives and olive oil are valuable foods to peoples in regions of Mediterranean climate, because of a lack of good pastures, except in irrigated fields, for fine dairy cows. Olive oil is the butter of these regions, it is used on salads, for cooking, for soap, and for ointment on face and hands as protection against the hot sun and dry wind In places olive farms cover vast hillsides and broad irrigated valleys; in others a few trees grow near the houses and with other crops of the small farmer.

**Citrus Fruits.** In this Mediterranean region citrus fruits reach their



*Sunkist Photo*

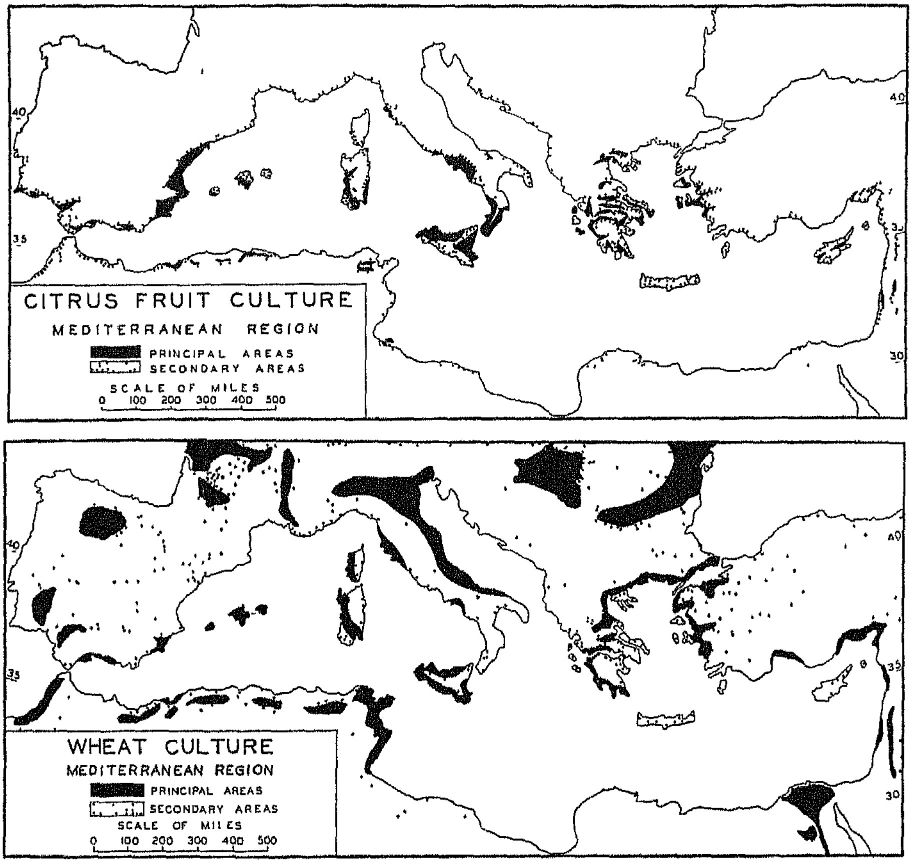
PICKING ORANGES, NEAR LOS ANGELES, CALIFORNIA

FIG 145 The citrus fruit industry of the Mediterranean region is much older than that of California What do you see in the picture that would favor the growth of oranges?

greatest development (Fig. 145). Spain is the world's principal orange producer and leads in the export of oranges. On the island of Sicily is the world's most important lemon industry; the lemon is less hardy than the orange but here at 38° N it reaches perfection, owing to fertile soils, high temperatures, much sunshine, the tempering influences of winds from the warm sea, and the use of the hillsides to gain the more direct rays of the sun.

**Wheat and Barley.** These two cereals are important crops in most regions of Mediterranean climate (Fig 146). They do well on hill lands, with small rainfall, high temperatures, much sunshine, and can be produced on small farms. The Mediterranean region is the native home of wheat. In Italy more than one-third of the cultivated land is in wheat, in Spain nearly one-third. Barley reaches greatest significance in northern Africa where it is as important as wheat and grows on one-fourth of the cultivated land. Both cereals are winter varieties, sowing taking place in late fall and harvest in early summer.

**Other Crops.** This region produces other cereals, vegetables, and fruits in great quantity. Most are used at home, but some are exported. The type of farming with a variety of products is best illustrated by a typical hill farm in west central Italy. From a hillside road we look across a small valley to a farm on the slope. The brown adobe house with red tile roof shows plainly in the bright sunlight. The house has two floors. In the upper




CITRUS FRUIT AND WHEAT AREAS IN THE MEDITERRANEAN REGION

FIG 146 Why are citrus areas more restricted than those of wheat? Wheat and barley are more important than other grains Sown in late September, they germinate during autumn rains Low winter temperatures arrest growth; but, watered by spring rains and seepage water from winter storms, they grow rapidly in warm spring weather They ripen under high temperatures of late spring and early summer They are harvested in hot sunny weather between May and July Threshing is done on hard earthen floors

part live the eight members of the farmer's family On the ground floor are stalls for oxen, rooms for farm implements, and cellars for wine and olive oil. Near the house is a round threshing floor, a small clay oven where baking is done, and a small corral. Back of these on the slope are garden patches for several vegetables.

Extending up the slope are rows of olive trees and grape vines; part of the vines near olive trees climb over them. Between the rows of trees are golden strips of wheat, barley, and corn. We cannot see them but our guide tells us that beans and melons grow with the corn. At the upper edge of the rows of trees we see the wall of a ditch from which water comes down the slope by the trees and

vines. Some of the moist slopes in this region get enough rain so irrigation isn't necessary Above the fields the rough ground is covered with sparse grasses and low green bushes. Among the bushes we see donkeys, goats, and sheep They graze high up the slopes In winter the higher parts of the mountains are covered with snow that gives water in spring and in early summer for irrigation. In summer many animals move into the mountains to graze. Up the valley we see many more small farms like this one Down the valley, the orchards and farmed fields become larger and larger and extend for miles and miles

## EXERCISES

1. (*a*) Locate the leading grape producing districts of the Mediterranean region (*b*) Why are grapes suited to the region?

EXPORTS OF WINE AND OLIVE OIL

(A recent year)

| *Countries* | *Wine* *Exports in Gallons* | *Per Cent of World Total* |
|---|---|---|
| World total | 531,538,000 | |
| Algeria | 296,894,000 | 55.8 |
| Spain | 92,110,000 | 17.3 |
| France | 28,882,000 | 5.4 |
| Italy | 27,218,000 | 5.1 |
| Tunisia | 25,634,000 | 4.8 |
| Portugal | 21,569,000 | 4.1 |
| Greece | 17,292,000 | 3.2 |
| Yugoslavia | 3,485,000 | .6 |
| Cyprus | 1,637,000 | .3 |
| Chile | 1,505,000 | .3 |
| Australia | 924,000 | .2 |
| U South Africa | 766,000 | .2 |
| Palestine | 264,000 | .1 |

| *Countries* | *Olive Oil* *Exports in Pounds* | *Per Cent of World Total* |
|---|---|---|
| World total | 610,728,000 | |
| Spain | 235,608,000 | 38.6 |
| Italy | 159,129,000 | 26.0 |
| Tunisia | 109,318,000 | 17.8 |
| Algeria | 54,218,000 | 8.8 |
| Greece | 15,869,000 | 2.6 |
| Turkey | 10,359,000 | 1.6 |
| Portugal | 7,934,000 | 1.3 |
| Syria | 6,392,000 | .9 |

2. (*a*) Where are the leading nine countries in the export of wine? (*b*) What percentage of the world's exports do they ship? (*c*) What other three regions having Mediterranean climate export wine? (*d*) What are the products of the same type of region in the United States?

3. What place do Greece and Spain hold in the export of raisins (p. 170)?

4. (*a*) What are the chief olive areas of the Mediterranean region? (*b*) How is the olive tree adapted to the region? (*c*) Why is the olive so useful? (*d*) What percentage of the world's exports is shipped from this region?

5. (*a*) List the reasons wheat and barley are important crops for regions of Mediterranean climate. (*b*) Name the important wheat producing areas of the Mediterranean region of Europe. (*c*) Important barley regions. (*d*) Which can stand greater drought?

6. Make a percentage chart of the world's exports of wine

7. Make a percentage chart of the world's exports of olive oil.

EXPORTS OF TWO MEDITERRANEAN COUNTRIES
(A recent year)

*Spain*

| *Products* | *Value of Exports* | *% of Country's total* |
|---|---|---|
| Total exports | $444,000,000 | |
| Fresh fruits | 76,594,000 | |
| Oranges | 62,800,000 | 17.3 |
| Olives and olive oil | 68,216,000 | 15.3 |
| Wines | 49,294,000 | 11.0 |
| Cork | 25,420,000 | 5.6 |
| Wool and hides | 19,332,000 | 4.2 |
| Fish | 19,179,000 | 4.2 |
| Vegetables | 17,250,000 | 3.8 |
| Nuts | 13,842,000 | 3.1 |
| Raisins | 3,500,000 | .7 |
| Minerals | 62,730,000 | |

*Tunisia*

| *Products* | *Value of Exports* | *% of Country's total* |
|---|---|---|
| Total exports | $55,211,000 | |
| Cereals | 16,847,000 | 30.9 |
| Olive oil | 11,432,000 | 20.0 |
| Wines | 2,841,000 | 5.4 |
| Wool and hides | 1,877,000 | 3.6 |
| Sponges | 1,200,000 | 2.1 |
| Dates | 548,000 | .9 |
| Cork | 450,000 | .9 |
| Minerals | 11,100,000 | |
| Phosphate | 7,100,000 | |
| Iron ore | 2,100,000 | |

8. (*a*) What percentage of the exports of Spain do fresh fruits make? (*b*) Oranges? All are products of a Mediterranean climate. (*c*) What percentage of the exports of Tunisia do the products of a Mediterranean climate make? It is significant that countries with small winter rains and summer droughts should depend so completely on such products for their exports.

9. (*a*) Make a list of the things the farmer will do in winter on the hillside farm in west central Italy; in spring, in summer; in autumn. (*b*) What products will the farmer have to sell?

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"The Grape Industry of Spain and Portugal" — A, V (1929), 183–193.

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"Farming and Grazing in Greece" — A, XI (1935), 92–100.

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"The Olive Orchard and Olive Culture" — 2, IV, pp. 310–315.

"Making and Marketing Olive Oil" — 2, IV, pp. 315–322.

"Value of Wine in Regions of Mediterranean Climate" — 2, IV, pp. 326 ff.

"Grape Culture in Spain and Portugal" — 2, IV, pp. 329–335; A, V (1929), 183–193.

"The Date Palm" — L, I (April, 1932), 13–18; 29.

"Grape Culture in Italy" — 2, IV, pp. 335–337; P, LXI (October, 1933), 12 ff.

"Grape Culture in France" — 2, IV, pp. 327–343; 24, pp. 445–448, and the text, Fig. 144; P, LXI (July, 1933), 7 ff.

"Wheat in Mediterranean Regions" — 2, IV, pp. 347–350, 352; A, II (1926), 88–89.

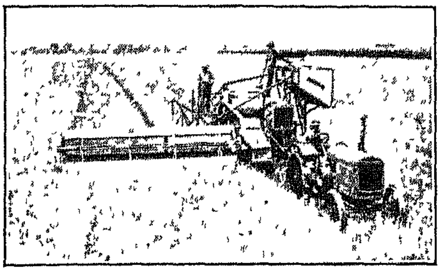
"Roses and Perfumes — Bulgaria and France" — 2, IV, pp. 404–411.

[8] Numbers and letters refer to Selected References on pages 420–424.

# CHAPTER XVI

# GRAIN FARMING IN SEMIARID PLAINS

Of the six major types of farming, grain farming in semiarid plains has least diversity. Every farm produces several food and feed crops for home use and some commercial crops, but wheat is by far the most important (Fig 147)



*Courtesy of International Harvester Company*

HARVESTING WHEAT WITH A COMBINE, KANSAS

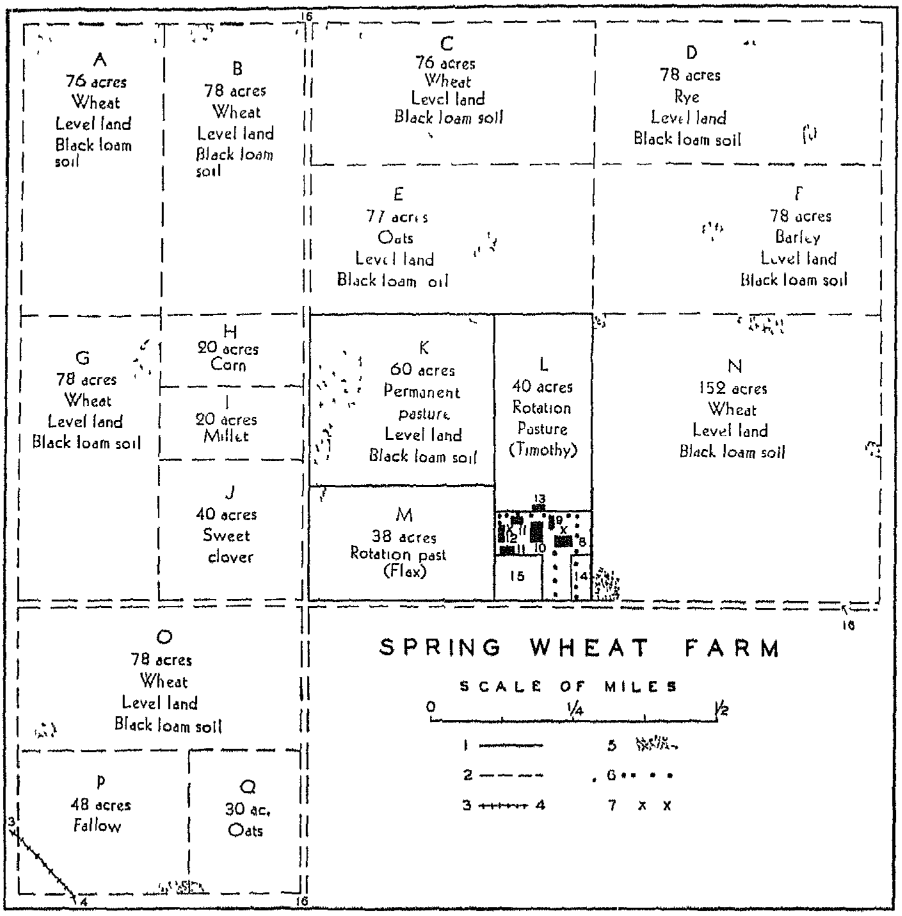
FIG 147 This machine represents the most modern development of wheat-harvesting machinery Its work is tremendous compared to that of the hand sickle, still used in monsoon and Mediterranean lands, and to that of the binder still used on small farms in Europe and eastern North America Level land that is dry and hard at harvest time is necessary for the operation of the combine The machine cuts, threshes, and dumps the wheat from the hopper on the right into a wagon or truck, a load at a time

## WHEAT FARMING IN THE UNITED STATES AND CANADA

**A Spring Wheat Farm.** The maps of two wheat farms, one in the spring-wheat region, the other in the hard-winter wheat region, give us a clear picture of wheat farming.

The Darkenwald spring wheat farm (Fig. 148) in southeastern North Dakota illustrates the type of farm found in the spring wheat region of north central United States and south central Canada This huge farm of 1120 acres stands out distinctly on the prairie for the nearest neighbors live from one to three miles away. It is about seven times as large as an ordinary Illinois corn farm and about three hundred times as large as a Japanese rice farm The level land makes road building easy and the use of large machinery possible Several crops are raised, but wheat is more important than all others combined Wheat always receives first consideration The farmer plants oats, barley, hay crops, and corn as rotation crops and to feed the work horses and the cattle, pigs, and chickens that furnish him with food, he plants flax on new land for it, like wheat, is a money crop, he plants rye as a rotation crop as well as a time saver because he can plant rye in the fall by disking the wheat stubble

The farmstead itself is composed of fifteen buildings some of which are not shown on the map surrounded by the only trees on the farm These trees were planted by the owner on the quarter section of land the government gave him. The implement shed, threshing machine shed, and blacksmith shop indicate that the farmer uses much machinery The horse barn has stalls for twenty-eight horses and room in the side sheds for many cattle and sheep. Two large granaries keep



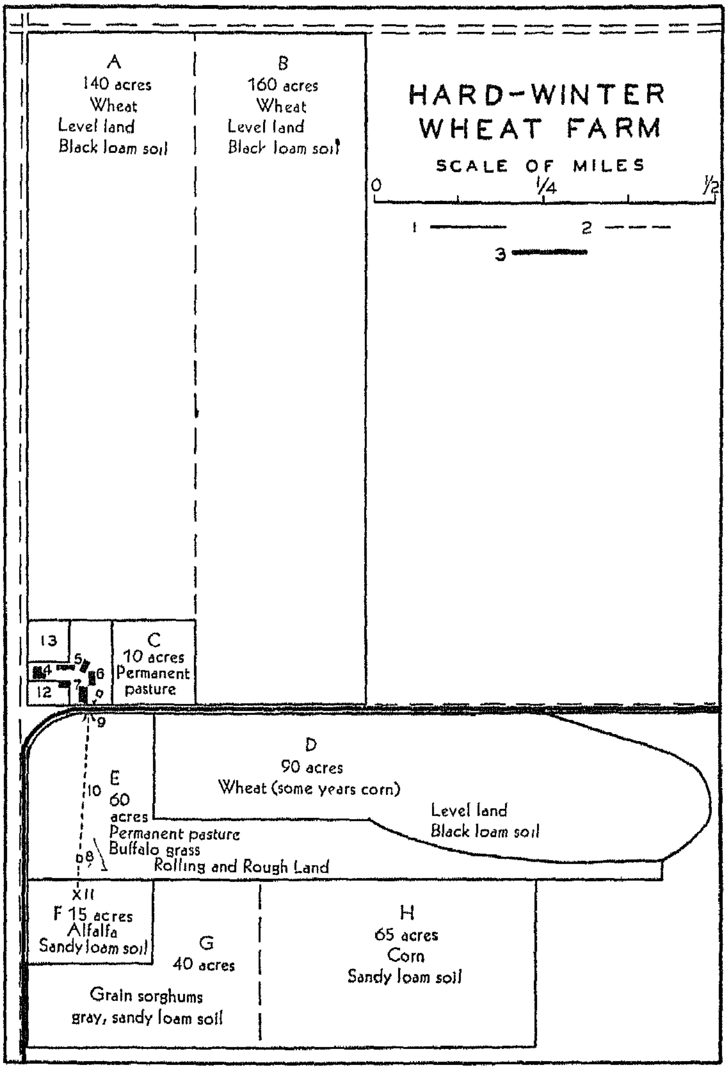

(Drawn from information supplied by Gordon Darkenwald)

THE DARKENWALD SPRING WHEAT FARM, WIMBLEDON, NORTH DAKOTA

FIG 148 1, Fences 2, Unfenced land and field borders 3, Railway, six miles to Wimbledon 4, Railway, four and one-half miles to Leal. 5, Depressions with slough hay 6, Trees 7, Wind mills 8, The farm residence. 9, House for harvest hands and hired men 10, Horse, cattle, and sheep barn. 11, Granaries. 12, Implement shed. 13, Threshing machine shed 14, Hog pasture 15, Garden. 16, Highways Total land area, 1120 acres, 133 acres are in hay land — slough hay, clover, millet, and timothy What percentage is in wheat? In oats, rye, barley? Can you explain why so little is in corn (p. 202)? The percentage of farm land of North Dakota in a recent year in different crops was wheat 50, oats 10, rye 5, barley 15, flax 5, hay land 15 Is this farm a typical one for North Dakota? Why does the farm have two houses?

the stock feed, seed grain, and grain that the farmer wants to sell later at high prices.

**A Winter Wheat Farm.** The Heath hard-winter wheat farm is in south central Kansas (Fig. 149). This farm, located in a longer settled and more densely populated region than the spring wheat farm, is about half as large The land is level in the north but rough in the south where it descends toward a stream. Note the change in the type of crops in the rough southern part. Wheat grows

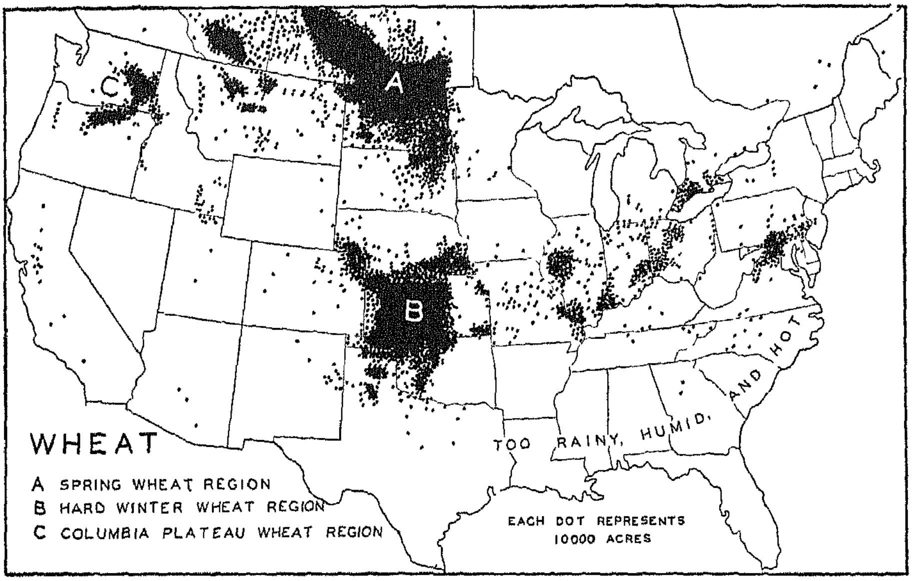



*(Drawn from information supplied by Herschel Heath)*

THE HEATH HARD-WINTER WHEAT FARM NEAR HAZELTON, KANSAS

FIG 149. 1, Fences 2, Unfenced land and field borders 3, U S Highway No 14, four miles to Hazelton, a railroad town 4, Houses. 5, Chicken house and implement shed. 6, Granaries 7, Barns 8, Tanks. 9, Cattle underpass. 10, Underground water pipe line 11, Wind mill 12, Hog house and pasture. 13, Garden The area of the farm is 590 acres What percentage of the land is in wheat? Find why the southern part of the farm is not used for wheat? The southern half of Field B has been in wheat for twenty years without rotation Fields C and E pasture about thirty head of stock

best on fertile level land where machinery can be used easily. Because of the southern location of the farm, corn, alfalfa, and grain sorghum take the place of the feed crops found on the spring wheat farm. Since flax,




WHEAT AREAS, UNITED STATES AND CANADA

FIG 150 What states and provinces are in the spring wheat region? The hard-winter wheat region? The Columbia plateau grows hard-winter and spring wheat in nearly equal amounts The wheat grown east of the Mississippi River is soft-winter wheat Why is not more wheat grown in southeastern United States?

oats, and rye do not grow so well here as in the spring wheat region and there are no good substitutes for them, crop rotation is practiced less, one part of the farm has been in wheat for twenty years. The buildings on the farm are similar to those on the spring wheat farm except that there are fewer because the farm is smaller and the climate milder, making protection for stock less necessary.

**Wheat Regions Comprise Vast Areas of Level Land.** The great wheat areas of the United States and Canada are found in three sections: the spring wheat region, the hard-winter wheat region, and the Columbia plateau wheat region, the smallest of the three (Fig. 150)

The level to gently rolling land of the spring wheat and the hard-winter wheat regions is ideal for roads, railroads, and machinery, all of which are absolutely necessary for the profitable production of wheat in these vast expanses The land of the Columbia plateau wheat region, though still suited to the use of machinery, is much more rolling (p. 177). However, the steeper slopes of the hills are often much eroded and constitute a problem that does not exist for the farmers of the other two regions In plowing around field "B," on the hard-winter wheat farm, how far would one travel? If a farmer plowed ten rounds a day with horses, how far would he travel? With a tractor, if he did twice as much, how far would he travel?

**Naturally Fertile Soil.** The early settlers found in these regions rich black or brown soils covered with an excellent growth of nutritious grass. The soil in this great grassland was much richer than that in the forest area farther east, largely due to two condi-

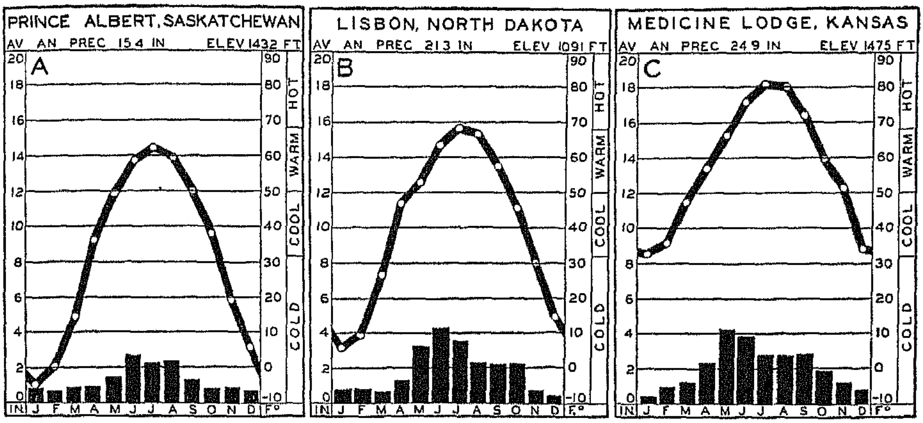



FIG. 151 Chart A is a station in the heart of the spring wheat region of Canada; Lisbon is in the winter wheat region of North Dakota, Medicine Lodge is in the heart of the hard-winter wheat region of central Kansas How long is the growing season in each place? Does wheat make use of the entire growing season in Kansas? Prince Albert has an annual rainfall of 15.4 inches and Medicine Lodge 24.9, both areas are about ideal for wheat, explain why wheat needs more rain in Kansas than in Saskatchewan Compare Chart C with Chart A, page 84, a station in the wheat region of Argentina

tions. The first, the low rainfall, prevented the plant food minerals from dissolving and being washed away, and second, in the fall the grasses died and added a rich humus to the soil The soil continued to be rich for a long time after the farmers started planting wheat because of the low rainfall, low yield of the crops which took little from the soil, and the use of legumes which added nitrogen and humus It was absolutely essential that the soil be rich for it would have been impossible to fertilize such large areas of land and still raise wheat profitably. Not only was the soil fertile but it was of excellent texture, easily worked, and for the most part had few stones and no stumps. These conditions were favorable to the use of the machinery so essential in wheat farming.

**Climate and Wheat Farming.** Wheat grows best in regions of low rainfall, the amount needed depends on the temperature of the region. In Prince Albert, Saskatchewan, a relatively cool region, fifteen inches are sufficient, whereas in Medicine Lodge, Kansas, where the higher temperatures cause greater evaporation, twenty-five inches are needed. However, more important than the average annual rainfall and temperatures is the seasonal distribution which can best be understood by a study of the different seasons on the farm (Fig. 151).

Winter on a wheat farm is the season of least activity. In the spring wheat area it is cold and the ground is covered with snow while in the winter wheat region it is much less cold and snow remains on the ground for only short periods. If the farmer had good crops and high prices the summer before, he may be on his vacation, leaving a hired man in charge of the farm. If not, he will be repairing machinery and harness, cleaning seed grain, and taking care of his stock If he stored grain from the harvest, he now has time to haul it to the elevator and will perhaps get a better price than he

would had he sold it during the harvest season.

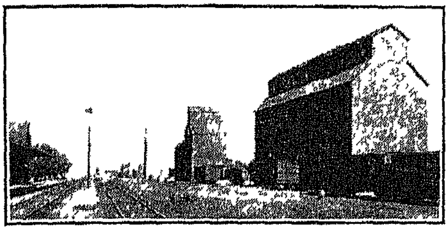
Spring brings much farm activity. In Kansas spring work begins in March, in southern North Dakota in April, and in Canada in May Spring comes rapidly, temperatures and rainfall increase How different are the things the farmer of the north is doing from those in Kansas Both are wheat farmers yet the Kansas farmer plants no wheat in the spring. He planted his in the fall for he is a winter wheat farmer. In the spring wheat region plowing begins as soon as the frost is out of the ground, disking, harrowing, and seeding follow. Wheat is generally planted first, flax and corn last The Kansas farmer plants only his corn and grain sorghum in the spring

With the coming of summer, temperatures in Kansas become high, even North Dakota has hot weather Rainfall, so necessary for the growth of wheat, increases, reaching a maximum in May in Kansas and in June or July in North Dakota and Canada The spring wheat farmer during the summer is busy making hay and preparing for the harvest. He worries a great deal about his crop for he may not get enough rain, too wet and damp weather may cause rust to ruin the crop, hail may destroy his crop, grasshoppers may eat the young plants, and last of all he is wondering if the wheat price will be high enough so he can sell his wheat at a profit. By midsummer the hard-winter wheat farmer is no longer worrying about those things for he is already harvesting his crop and will soon be plowing for the next

Fall ushers in the most active of all seasons in the spring wheat region. Temperatures are hot during the day but cooler at night and the rainfall has become less, making the harvesting easier Reapers are busy cutting and binding the grain, or huge combine-harvesters, pulled by great tractors or by from sixteen to thirty-two horses, are cutting and threshing the grain as they move across the firm ground of the dry field Many men are needed during this season Men who are helping here may have, a month or so ago, been harvesting wheat in Kansas At this time in Kansas the farmers are plowing the land and seeding the wheat for the next year's crop. You probably wonder why the northern farmer doesn't plant his wheat in the fall like the southern farmer There are three reasons. The northern farmer finishes harvesting too late to plow his land and get his wheat planted in time to give it a chance to grow before frost occurs. The rainfall is so low in late fall that the plant might not receive enough to be able to grow even if it did have time. The severe winters in the north with freezing and thawing would "winter kill" the wheat

**Extensive Farming Practiced.** The wheat grower of these regions farms on an extensive scale. One man, with the use of much machinery, farms hundreds of acres of land This is just the opposite of the intensive farming in Japan where a man tills by hand an acre or two. The chief reasons for extensive farming in the wheat areas of the United States and Canada are · the early settlers were few in number in a vast territory, hence had access to all the land they could cultivate; the level land covered with grass rather than forest made cultivation of large areas possible; the rich soil did not require fertilizer, hence a man with little money could cultivate as much as he had time to plant, the rapid develop-

ment of machinery soon gave the farmer excellent plows, binders, etc., the development of railroads and the demand for wheat made it profitable, the much lower cost of extensive production made the more expensive intensive cultivation unable to compete, and the climate, favorable for wheat, a great commercial crop, kept out all possible competitors for this fertile level land.



*Courtesy of International Harvester Company*

GRAIN ELEVATORS, LARIMORE, NORTH DAKOTA

FIG 152 In level country these tall elevators can be seen for miles, they are very essential in handling in bulk large crops of wheat The semiarid wheat lands have many small towns engaged in shipping wheat because the farmers cannot haul it long distances

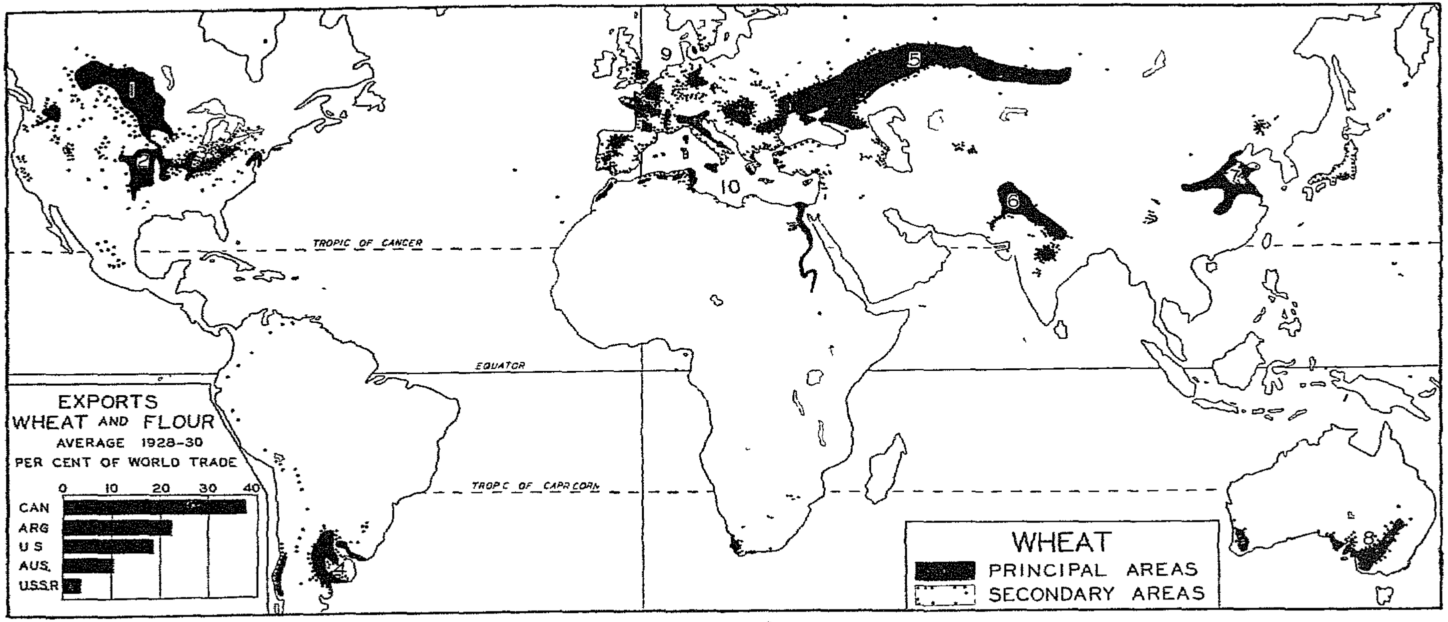
**Transporting the Wheat from Farm to Flour Mill.** Because wheat is a commercial crop of considerable bulk, and because the wheat regions need so many bulky supplies such as coal, lumber, and machinery, the problem of cheap transportation is exceedingly important (Fig 152).

The actual number of miles from farm to market is not the most important factor in considering the cost of transportation. The type of transportation used largely determines the cost. For example, it costs a farmer as much to haul his wheat ten to fifteen miles by wagon to the village elevator as it does five hundred miles by railroad to the terminal or three thousand miles by boat on the ocean. As a result, the aim of the farmer is to use water transportation as much as possible and wagon and rail as little as possible

The village elevators in Saskatchewan and Manitoba send their wheat by rail to Winnipeg where it is graded and sent on by rail to Port Arthur or Fort Williams on Lake Superior. Thence it goes by lake boat to Montreal or by lake boat and barge or lake boat and railroad to New York From Montreal or New York it is shipped to Liverpool, Rotterdam, or other foreign ports. Alberta wheat usually goes by rail to Vancouver The spring wheat of the United States goes by rail to Minneapolis where it is graded and then continues by rail to Duluth or Chicago Here it is loaded on lake boats and continues to Montreal or New York. Wheat bound for New York is reloaded at Buffalo in either railroad cars or barges Hard-winter wheat goes by rail to Kansas City, thence to New Orleans or Galveston Columbia plateau wheat goes by rail to Seattle or Portland The great disadvantage of our long rail haul is best shown by the fact that the Argentine farmer, because he lives near the sea, can get his wheat on the Liverpool market several cents a bushel cheaper than the American farmer in spite of the fact that the Argentine ports are twice as far from Liverpool as New York is (see the railways pp 404–405).

## WHEAT IN OTHER REGIONS

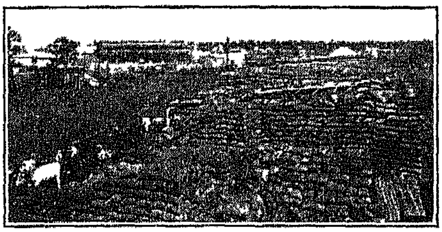
**The Pampa of Argentina.** Argentina ranks second in the world export of wheat Most of her wheat is grown in a crescent-shaped area in the western part of the pampa (Fig. 153). Although Argentina exports more wheat than the United States, she produces only one-third as much The reasons




WHEAT AREAS OF THE WORLD

FIG 153. 1, The spring wheat region of North America 2, *Hard-winter wheat region* 3, Soft-winter wheat region 4 The wheat crescent of the pampa 5, The winter and spring wheat region of Russia and Siberia 6, The wheat region of India 7 The plains of North China 8, Australia 9 Northwest Europe 10, The winter wheat region of Mediterranean lands Wheat is chiefly a temperate crop, but some areas within the tropics grow wheat. What factors explain this (pages 150 and 151)? What percentage of the world's exports of wheat do *the five leading countries supply*? Why is wheat so important in Mediterranean lands (page 173)? In China and Japan?

for the large production of wheat in Argentina are vast areas making it possible to raise a large quantity, level land excellent for machinery and transportation, rich grassland soil not requiring fertilizer, and a climate suitable to wheat The chief reasons for the great export are small population (less than one-tenth as many as in the United States), a territory close to the sea which lessens rail haul and makes it possible for her to sell in Liverpool cheaper than the United States can, and a lower standard of living which makes labor cheap.



*Courtesy of Commonwealth Immigration Office*

WHEAT AT A RAILWAY STATION IN AUSTRALIA

FIG 154. The sacked wheat is hauled on huge wagons drawn by oxen or horses to the railway station whence it is moved to the ocean port. Handling wheat in sacks is more expensive than handling it loose in bulk, but the wheat regions of Australia and Argentina do not have wood or other materials to make country elevators at a reasonable cost.

**Australian Wheat.** Australia resembles Argentina in physical and economic advantages for wheat (Fig 154) Australia has the same extensive methods of wheat production Most of its wheat goes to Europe, over what routes does it move (p. 402)?

**Russian and Siberian Wheat.** Physical conditions for wheat in Russia and Siberia are similar to those in the United States and Canada though the region on the whole is nearer the sea However, methods of production are backward chiefly because of the lack of education, unstable governmental conditions, poor farming population, very poor transportation, and the lack of natural resources for the production of machinery Russia and Siberia produce about two-thirds as much wheat as the United States, whereas they export only about one-fourth as much They have a larger population than the United States and in spite of the fact that their poor people use rye instead of wheat, they consume a large quantity of wheat at home Their crop production fluctuates greatly so that one year they may have a great deal for export while another year they may have little surplus.

**World Wheat Trade.** Wheat ranks as one of the greatest of the commodities of international trade. It is produced where population density is low and is shipped to great population regions for consumption. The United States and the U S S R., the greatest producers, have such a large home population that their exports are relatively low

Northwestern Europe takes most of the world's exports of wheat, in spite of the fact that it produces much itself For example, England produces only eight to ten weeks' supply of wheat Why are Italy and Japan also large buyers of foreign wheat?

## EXERCISES

1. (*a*) In two columns compare and contrast the spring wheat and hard-winter wheat farms (*b*) Answer the questions under Figs. 148 and 149.

2. (*a*) Answer the questions to Fig. 150 (*b*) Make a list of the physical and economic conditions favoring wheat farming in the regions A and B. (*c*)

Make a list which brings out the contrasts shown by the charts in Fig 151.

3. Make a list of the agricultural implements used in the extensive culture of wheat and the work done with each implement. Refer to text, pictures, and references

4 (*a*) Answer the questions under Fig 153 (*b*) Why does Europe take most of the export wheat? (*c*) Write in a list the common conditions that make it possible for regions 1, 2, 4, 5 and 8 to ship 90 per cent of the world's exports of wheat The text, the annual and seasonal rainfall (pp 12–13, 62–63), relief (pp. 10–11), population (pp. 4–5), and transportation (pp 404–405) maps will help you

5 Review wheat production in monsoon and Mediterranean lands (pp 151 and 173) Why are they not great exporting regions?

6 Review exercise In table form contrast wheat production on the Darkenwald spring wheat farm and rice production in Japan

## SUBJECT FOR A DEBATE

Resolved that the wheat farmers in the hard-winter wheat region should diversify their crops

## AN EXTRA LESSON

"The Columbia Plateau Wheat Region" — A, IX (1933), 182–190; B, XXX (1931), 265–279; 87, pp 525–529

## READINGS[1]

"The Bread of the World" — 9, pp. 12–22, 24, pp. 14–15; 13, pp 36–40, 94, pp 51–53; 2, I, pp 111–124, L, II (July, 1932), 13–18.

"The Geography of Production of Wheat" — A, I (1925), 37–48, good pictures; 95, pp 21–30; 23, pp. 42–69; 94, pp. 52–62.

"The Spring Wheat Region of North America" — 87, pp 345–356; A, IV (1928), 399–433, excellent pictures.

"The Winter Wheat Region of the United States" — A, III (1927), 327–339; 87, pp. 339–344.

"Wheat in South America" — 17, pp. 139, 209, 385–390, 95, pp. 305–306.

"Producing and Marketing North American Wheat" — 12, pp 236–245

"Wheat in Russia" — A, VIII (1932), 173–176; J, XXI (1931), 1–21.

"Wheat in Australia" — A, VI (1930), 129–132, 223–229, 26, pp. 150–151, 212–222, 255–259, 341–342.

"The Story of Wheat" — H, II (1931), 89–114.

## TOPICS FOR INVESTIGATION AND REPORT

"The Effect of Machinery on Wheat Production" — 23, pp 52–57, 106 (1927), 692–695, 12, pp 239–241.

"A Year on a Canadian Wheat Ranch" — 1, pp. 311–320.

"From the Wheat Farm to the Flour Barrel" — 7, I, pp. 237–240; 9, pp. 22–28, 37–44; 13, pp. 53–59; 1, pp. 322–324

"A Table of Wheat Harvests" — list the nine wheat regions shown on Fig. 153 and work out the months of harvest in each region, 13, pp 36–39

"The Climatic Requirements of Wheat" — 95, pp. 21–22; 23, pp 42–52, 24, pp 15–28.

"How Rye Moved into the Spring Wheat Region" — 106 (1922), pp. 503–508.

"Flax for Seed" — 106 (1922), pp. 533–543, 545–546

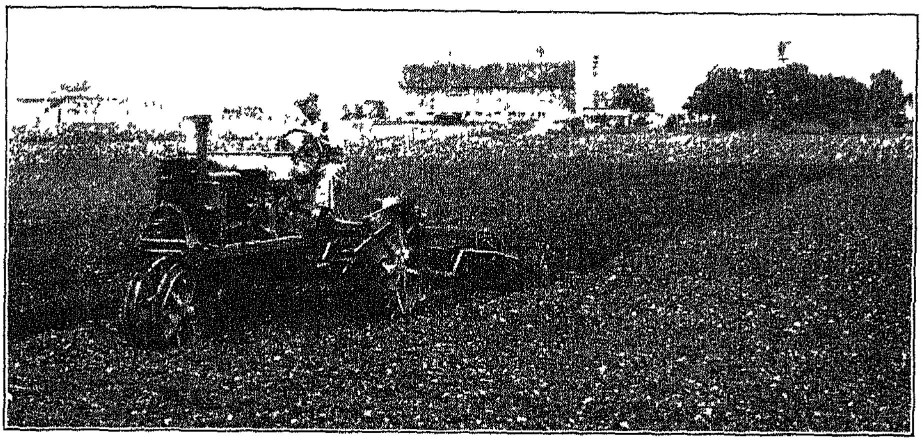
"The Combine and Its Uses" — 106 (1927), pp 692–695.

[1] Numbers and letters refer to Selected References on pages 420–424

## CHAPTER XVII

# MIXED FARMING IN TEMPERATE LANDS

As a group, the farms in temperate lands upon which mixed farming is practiced have the greatest capacity for providing all the needs of the farmers In no other type of farming do we find the people engaged in so many kinds of agricultural activity on a large scale Commonly the individual farm produces several field crops, vegetables, and fruits for home use, and a large variety of animal products (Fig 155)



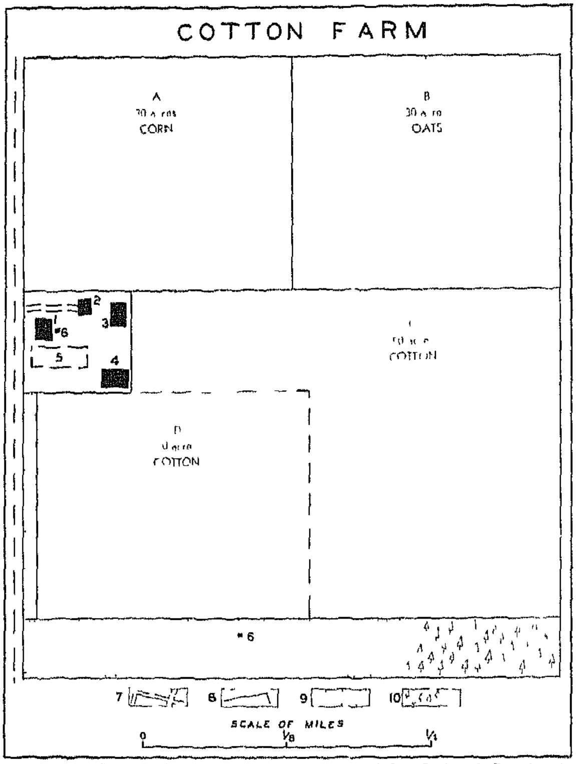
*Courtesy of International Harvester Company*

A FARMSTEAD IN ILLINOIS

FIG. 155. This picture illustrates well the variety of products on the farms where mixed farming is practiced, especially those of the corn belt and western Europe and to a less extent those of the cotton belt From right to left the farm layout embraces. the house among the trees, chicken houses, horse and cow barn, corn cribs, hog house, tool shed and hay barn, and bunks for beef cattle This farmer sells cattle, hogs some cream, and his wife sells eggs and chickens He grows corn, oats or barley, hay for feed, and vegetables and fruit for food He has twenty agricultural implements

## § I — COTTON AND MIXED FARMING

**A Texas Cotton Farm.** Figure 156 illustrates a farm in the western part of the cotton belt of the United States. It is only about one-seventh as large as the Darkenwald spring wheat farm (p. 178). The level land and fertile black soil make most of the farm usable for crops. Several crops are raised but cotton is the chief one, requiring most of the work and supplying most of the farm income. The farmer plants corn, oats, or wheat and sometimes hay as rotation and as food and feed crops In general three men do the work on this farm, but the Negro's wife and children help in the fields in several ways. At harvest time more laborers are needed.




*Drawn from information supplied by J. Fred Smith, Jr*

A TEXAS COTTON FARM

FIG 156. 1, House 2, Garage 3, Negro house 4, Barn 5, Garden. 6, Wells 7, Road 8, Fences 9, Permanent pasture 10, Woods This farm contains 160 acres, fifteen acres are in permanent pasture and woods, and five acres in lots and garden How many acres are crop land? What per cent of the crop land is in cotton? Corn? Oats? Some years the farmer plants wheat instead of oats The cotton farmer in Georgia does not grow oats or wheat Why (page 180)? The farmer, his son, and one Negro work this cotton farm with six mules. What machinery will they use? The farmer keeps two cows, twelve sheep, four to eight hogs and twenty-five hens

**A Year's Work on the Cotton Farm.** Each season finds the farmer doing a definite type of work. Sometimes he is very busy and has much help, while at other times the farm work is light and the farmer may take a vacation if the past year has been profitable. Each season the same grave problems confront him and each year he is wiser from experience. When new problems present themselves for solution the farmer must solve them or fail He is not left alone with his problems, however, for the United States government and the state universities coöperate in helping him. If he is a wise farmer he will heed their advice based on scientific experiment.

Winters in the cotton belt are short and mild (Fig. 157), the southern part having only two or three months in which frost is liable. Winter cold waves are welcome in the cotton belt for they destroy many of the boll weevils that are hibernating in old cotton plants and waste material. Precipita-

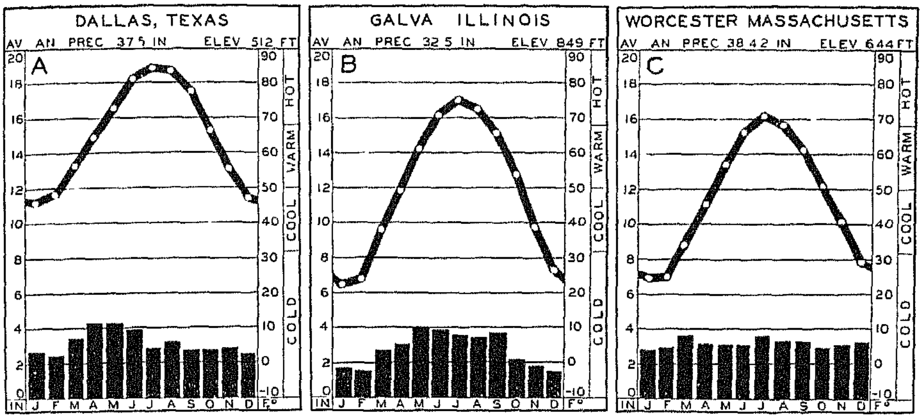



FIG. 157 Chart A shows the temperature and rainfall of the Texas cotton farm. How long is the growing season? How long is the growing season on Chart B? Chart C? Contrast the amount and distribution of rain of the 3 stations.

tion during the winter usually comes in the form of rain and is considerably less than during the balance of the year, a condition necessary to the best development of the cotton plant. In February the farmers cut the old cotton stalks and either burn them or plow them under.

In the southern part of the cotton belt the danger of frost is past about March 1, whereas in the northern part it is not past until the latter part of April. Mild springs accompanied by light but frequent showers are ideal for the cotton plant. If the spring is too wet, the seeds rot or the young plants will fail to send down long tap roots, hence later in the season they may suffer from a lack of moisture. The farmer is very anxious to get his crop planted as soon as possible because he wants to have it mature before the weevil does too much damage. Before planting his seed the farmer harrows the land to make it smooth. He then takes off all the shoes from his cultivator except the outer two and with it marks out his field. The planter opens a furrow, drops fertilizer and seed, and closes the furrow. Fertilizer is used extensively only in the eastern part of the cotton belt. A large quantity of seed is planted because the farmer wants to be sure of a thick stand. He selected his seed carefully in order to secure a plant that will mature early and produce a long fiber. He bought the seed from a reliable seed company or with great care raised it himself. After the plants are well above the ground, the workers chop out enough plants to leave growing plants from ten to twenty-four inches apart. The better the soil the farther apart must be the plant for it will grow bigger. A wide spacing of the plants makes more sunlight available, and thus reduces the danger of pests and diseases.

During the summer, days and nights are both hot, while rain is plentiful and generally of the thundershower type. Often it rains at night which pleases the farmer because cotton needs much sunshine. When a period of prolonged hot dry weather is experienced, many boll weevils are killed for they cannot stand great heat especially when drought accompanies it. The normal

PLOWING AND PICKING COTTON, GEORGIA

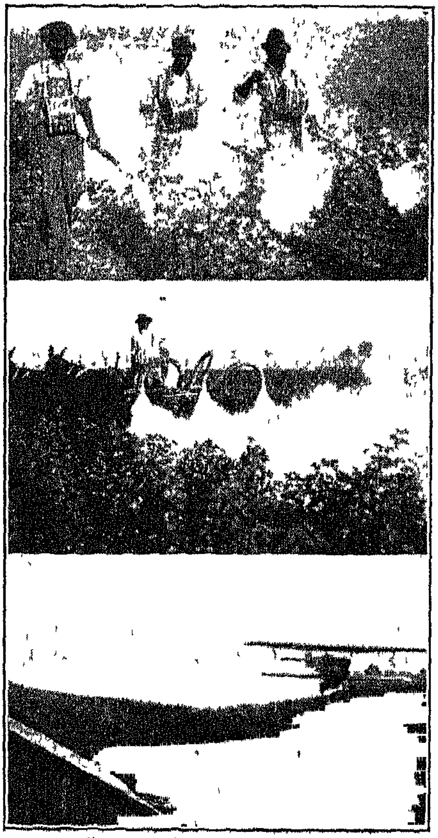
FIG 158 This picture, taken in August, shows plowing to keep down weeds, and picking of cotton at the same time. This cotton field had been picked over twice, two or three more pickings were required to get most of the cotton

warm weather with frequent rains not only makes the cotton grow rapidly, but gives ideal conditions for weeds, so the workers have to cultivate and hoe the cotton plants many times (Fig 158) During hot weather, when much work must be done, the Negro is especially useful for he can stand the heat better and will work for lower wages than the white man.

The cultivator is usually drawn by a mule, sometimes two. Mules are better suited to hot weather than horses and are bothered less by the insect pests of this moist region. As the Negro and his mule go back and forth through the field care must be taken not to cultivate too deep or the tiny roots of the cotton plant will be torn and thus the food supply for the growing plant will be partially cut off With good weather and careful cultivation, the plant soon has flowers which fall and are replaced by young bolls The plant blooms and forms boll buds several times. Soon after the flowers drop the great battle between man and the boll weevil begins. The owner's first army consists of children who walk through his fields and carefully pick young weevils and gather fallen bolls. Fallen bolls indicate that the weevil has attacked them and young insects are sure to be found inside Later the farmer dusts the plants with poison (Fig 159) With this care he prevents the rapid multiplication of the boll weevil

The home food and feed crops such as corn, hay, and vegetables require care, but cotton receives first consideration since it is the money crop.

In the southern part of the cotton belt picking begins in July, and in the northern part about two months later At about the time of first picking, rain-



*Courtesy of United States Department of Agriculture*

THREE METHODS OF DUSTING COTTON

FIG 159. If the farm is small, the farmer may use hand dusters, a machine duster covers larger fields more quickly, the most rapid method of dusting on huge farms is by airplane dusters

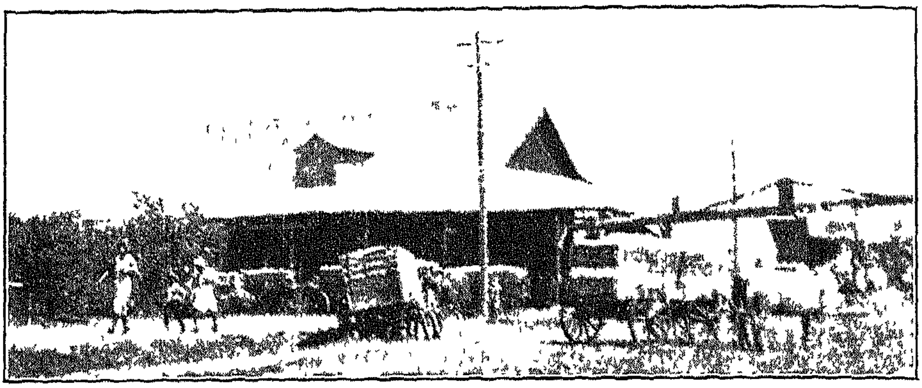
Fig. 160 Picking Cotton Is Hard and Hot Work

fall and temperatures are decreasing This is very desirable because too much rain during the picking season discolors the cotton The decrease in temperature is most noticeable during the nights which now become cool The cool nights help to stop the vegetative growth of the plant and then the bolls develop rapidly and burst open. An early frost will kill the "top crop" or the young bolls on the top of the plant. Because of the irregular ripening of the cotton it is necessary to pick several times Picking the cotton is the biggest single job of the farmer. Men, women, and children all have to go into the fields (Fig. 160) Recently a cotton picker has been invented (p. 365). Cotton picking lasts two or three months, sometimes longer

In the autumn old cotton stalks are cut, then burned or plowed under Fall plowing covers the old stalks and kills the boll weevils that otherwise would hibernate in them At the same time it turns up grasshoppers, cutworms, and other insects that have worked their way into the ground for the winter. The upturned loosened soil gathers moisture more easily, an important consideration for the young plants if the spring happens to be unusually dry.

**From Cotton Field to Spinning Mill.** Cotton is taken directly from the field to a nearby cotton gin where the seeds are removed from the lint For every pound of cotton lint there are two pounds of seed Thanks to Eli Whitney, the removal of the seed is comparatively easy (Fig 161) Before Whitney invented the cotton gin, the cost of removing the seed from the lint was greater than all other costs of cotton production combined The cotton is baled at the gin and then taken to a nearby village and sold Cotton buyers in these villages are purchasing a certain quality of cotton for customers who want just that type. After purchasing the cotton, the village buyer sells by telephone to agents in central markets, ports, or cotton mills. Next day he ships to these agents who in turn resell it to the mills in the United States or export it Often the original buyer sells directly to mills.

Transportation is by means of mule team to the gin, and by mule team or small truck to the village where it is first sold From there it may go by large truck or train to the central cities or ports, where it will be shipped by



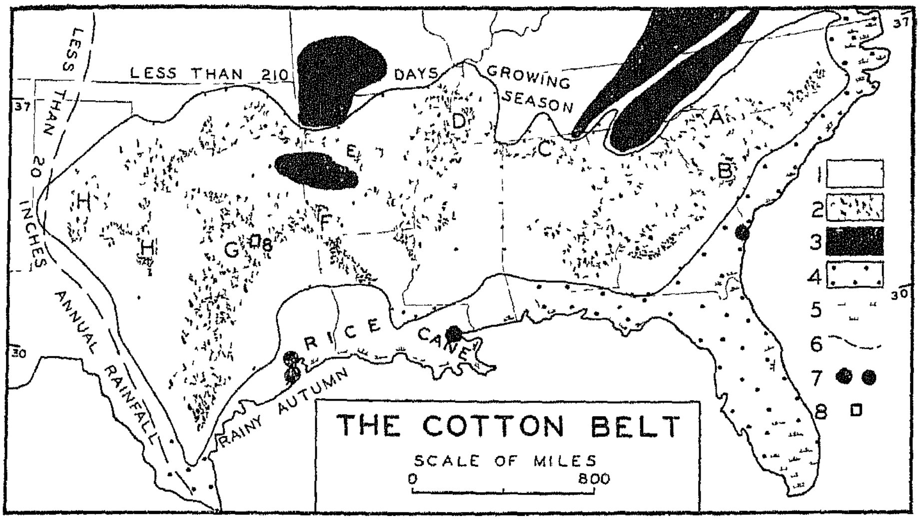
A COTTON GIN, ALABAMA

FIG 161 In nearly every town in the chief cotton regions is a cotton gin The picture shows wagons waiting their turn to unload

rail or boat to the northern manufacturing plants or by steamer to the foreign markets The problem of transporting the cotton is favored by mild weather, which gives open roads and harbors at all times. The numerous railroads, many excellent truck roads, and boats on southern rivers, combined with the short distance to excellent all-year harbors, make the transportation cost low In addition to the natural advantages, cotton is more valuable per unit of weight than such commodities as wheat or corn and hence can stand a greater transportation cost

**What Determines the Limits of the Cotton Belt?** Cotton is very exacting in its demands on climate and as a result grows only in certain areas (Fig 162). This fact combined with the great demand for cotton makes it the most important crop within suitable climatic limits Cotton is a warm-climate plant; its northern limit is reached where the growing season becomes less than two hundred days or where the summer temperature averages less than 77 degrees Fahrenheit. Mountainous country also limits the northward extension, especially the Appalachians, Ozarks, and Ouachitas. In the west where the annual rainfall is less than eighteen inches, cotton cannot be grown profitably Even with eighteen inches of rain there is constant danger of drought However, the cooler and drier margins are less favorable to the boll weevil. In the south, sandy soil, swamps, and the more favorable conditions for rice and sugar are partially responsible for that limit. However, more important is the fact that autumn rains here exceed ten inches with the result that the cotton fibers become stained, while the moist conditions favor the boll weevil The same favorable climatic conditions for the boll weevil in the east ruined the long-fiber sea-island cotton crop to such an extent that its production was given up. Sandy soil and better returns from tobacco and vegetables also played a part.

**Major Producing Regions within the Cotton Belt.** Though the cotton belt itself is determined largely by climatic conditions, yet within this area are regions where favorable relief and soil conditions contribute to a great concentration of cotton production




THE COTTON BELT OF THE UNITED STATES

FIG 162 1, The cotton belt 2, Chief producing regions — A the Piedmont, B Inner Coastal Plain, C the Tennessee Valley, D the Yazoo Delta or Alluvial Plains of the Mississippi, E the Arkansas Valley, F the Red River Valley, G the Black Waxy Prairies, and H the Black Prairies of western Texas 3 Highlands 4, Sandy soil areas 5, Coastal swamps 6, Twenty-inch annual rainfall line 7, Chief cotton exporting ports 8, Location of cotton farm (Fig 156) The chief producing areas are those of fertile alluvial river bottom soils, black prairie soils or the heavily fertilized soils of the inner coastal plain, and the piedmont What four things keep cotton out of southern Texas and Louisiana? What limits the cotton belt in the north? In the west? In the east? Why is the western part of the cotton belt wider than the eastern?

Both the piedmont and inner coastal plain belts owe their importance to a combination of many factors Soils in these regions are of excellent texture which makes cultivation easy, but continuous cotton growing for so many years, combined with heavy precipitation, has greatly reduced their fertility. As a result large quantities of fertilizer must be used. An early start in cotton production has made the region adjust itself to cotton economy which is difficult to abandon. Furthermore, at present the development of manufacturing in this section encourages the industry by giving it a nearby market. In spite of the boll weevil which is very bad in these regions, cotton yields, where considerable fertilizer is used, are higher than the average for the cotton belt.

The four major river-bottom regions, consisting of the Tennessee Valley, the Yazoo Delta, the Arkansas Valley, and the Red River Valley, are areas of concentration of cotton production. The lands are level and the soils are exceedingly fertile The soil in these areas has been brought from the rich black and brown soils of the west Because of their great fertility, no fertilizer is needed. The soils of the Tennessee Valley are not so fertile as those of the western valleys and Yazoo Delta, though much more so than those of the piedmont and inner coastal regions. Yields are high in these areas, reaching 265 pounds per acre in the Yazoo Delta, the highest yielding region in the cotton belt

The black waxy prairies of Texas with their rich black calcareous soil full of lime are excellent for cotton production The undulating or flat land is well suited to the use of machinery and not susceptible to erosion Less rainfall with greater variability keeps the average yield per acre lower than that of more humid regions However, the drier conditions are unfavorable for the boll weevil The black prairies of western Texas have level rich black soil The heavy soil of this region prevents the crop from maturing early and as a result the boll weevil gets a good chance to harm the crop Because of that and the many years of continuous cropping, the yields are low.

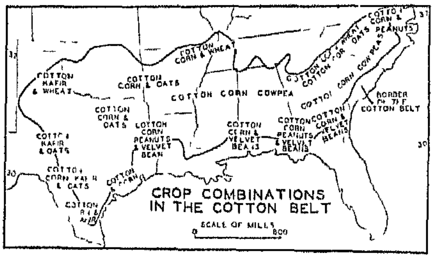


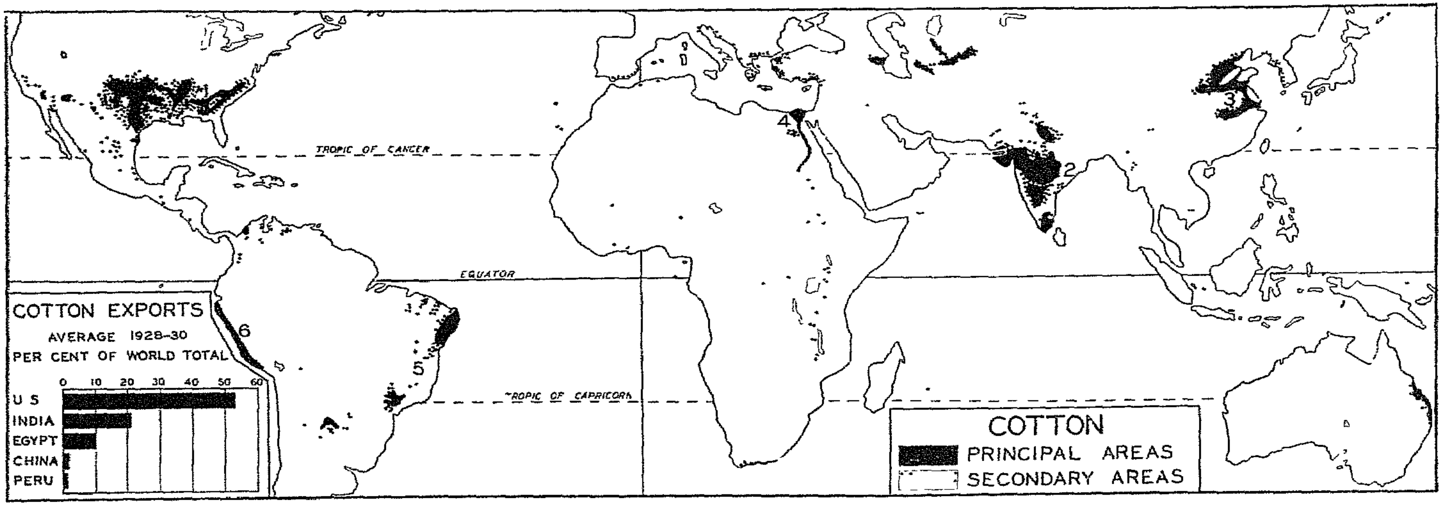

FIG 163 CROP COMBINATIONS IN THE COTTON BELT

**Other Crops in the Cotton Belt.** Although cotton is the great crop of the cotton belt, more than half of the cultivated land is planted in other crops, chiefly feed and food crops (Fig. 163). Corn ranks first with an acreage in many places nearly as great as that of cotton. The corn is used for stock feed as well as for home consumption by the people Climatic conditions are excellent for corn production Oats for horse and mule feed is grown in small amounts. Peas, peanuts, and other legumes are raised for stock feed as well as for fertilizing the ground. The legume puts nitrogen into the soil and when plowed under green adds humus Vegetables are grown to supply the homes Because of the long growing season, fresh vegetables are available most of the year Near large cities the farmers raise vegetables for marketing Fruits are grown in nearly the whole region for home consumption while in Georgia and Texas great quantities of peaches are raised for market

**Livestock in the Cotton Belt.** So common is the mule on the cotton farm that the size of the farm is generally spoken of as a one-mule farm or a two-mule farm rather than by acres Because the mule can stand hot weather, he is better suited to this region than the horse. The mules are raised in the corn belt, where more feed is available, and when old enough to work are sent to the cotton belt In general the farms are too small and the Negro too poorly educated to make the use of tractors advisable Dairy cattle to supply the home needs are found on a large proportion of the farms because milk and cream are expensive to bring in from the outside Beef cattle are few in number as it is cheaper to import meat from the corn belt than to raise it Swine and poultry are grown in small numbers on most farms, though much of the pork also comes from the corn belt

## COTTON IN OTHER LANDS

**Egyptian Long-Staple Cotton.** Cotton is Egypt's most important crop (Fig. 164). It is grown under irrigation, thus receiving water at the proper time. Irrigation, fertile soil, and small trouble with pests make possible yields that are on the average more than twice as high as those in the United States. Since the total




Cotton Producing Areas of the World

Fig. 164 1 The cotton belt of the United States 2, The plateau of India 3, The north plain of China 4 The Nile Valley 5, Eastern Brazil 6, The Peruvian Coastal Desert Name several secondary producing areas Which of the major cotton producing areas of the world are in regions of dense population (pp 4–5)? In regions of very light rainfall (pp 12–13)? Cotton production is expanding into many new regions, among them are the Chaco of Argentina, eastern Australia, Asia east of the Caspian Sea, and the several areas in central Africa

area of irrigated land is small, Egypt does not rank high in production when compared with the United States Why is it, then, that the United States imports cotton from Egypt? Egyptian cotton has a long, strong, silky fiber in great demand for high quality cloth and automobile tires. The sea-island cotton we raised before the boll weevil ruined the industry was somewhat like Egyptian cotton Now, however, we have to import our long-staple cotton fiber Can you tell why the boll weevil would do less harm in Egypt than in the islands east of the Carolinas?

**Cotton Production in Brazil.** Brazil produces some ordinary cotton in the São Paulo region but much of her cotton, produced in northeast Brazil, comes from a cotton tree which yields cotton for about five years The quality of Brazil's cotton is low and she does not have a large amount. Most of the crop is consumed at home.

**Cotton from the Peruvian Desert.** Peru today raises more than four times as much as she did in 1900 At the present time cotton constitutes one-fourth of her total exports. A lack of hail, no rain to aid the boll weevil or stain the fiber, controlled water supply for irrigation, uniformly high temperatures, and plenty of fertilizer in the nearby guano islands make it possible for Peru, with poor production methods, to get a larger yield of good quality cotton per acre than the United States. One type of cotton raised in Peru is crinkly and is used a good deal to mix with wool. Most of the cotton, however, is of fairly long staple, strong and silky. It is used especially in the manufacturing of heavy tire fabrics and high-grade cotton textiles in northwestern Europe and eastern United States.

WORLD TRADE IN COTTON

Cotton is the dominant agricultural commodity in international trade It is in demand universally for men's, women's, and children's clothing It is used in tires, for paper making, for the production of celluloid, and has innumerable other uses The seeds are used for oils, oleomargarine, and soap, while the hulls of the seeds are used for fertilizer and stock feed Because cotton demands a warm humid climate and because the major cotton manufacturing and consuming regions of the world are in more temperate lands, it is necessary to ship the raw cotton for manufacture To be sure, cotton manufacturing is developing in southern United States and other regions of production also, but northern United States, Europe, northern China, and Japan, as well as less densely populated temperate regions, demand most of the cotton for their mills and people.

The United States produces and exports more than half the cotton of the world. India ranks second as both producer and exporter Egypt is also an important exporter but China and Peru export little The United Kingdom, Japan, Germany, France, and Italy are the greatest importers of raw cotton which they manufacture and sell at home and to less industrialized foreign countries. The important cotton shipping ports are Galveston, Houston, New Orleans, Savannah, and Bombay Liverpool, Manchester, Yokohama, and Hamburg are among the chief importing points of Europe and Asia.

## EXERCISES

1 (*a*) In table form contrast the size, fields, buildings, and crops on the Heath hard-winter wheat farm and the Texas cotton farm (*b*) Make a list of the machines each of these farms uses

2 Outline in detail the work on the Texas cotton farm in the following seasons (*a*) spring, (*b*) summer, (*c*) autumn, (*d*) winter

3 (*a*) In outline form contrast the climatic conditions shown in Chart A (p 189), and Chart C (p 136) (*b*) List the ways the cotton plant is related to climate.

4 (*a*) Answer the questions to Fig 162 (*b*) Account for the chief producing areas.

5 From Fig 163 list the crop combinations in the following areas (*a*) central North Carolina, (*b*) northern Georgia, (*c*) southwestern Georgia, (*d*) northern Mississippi, (*e*) southern Louisiana, (*f*) southern Texas, (*g*) central Texas

6 (*a*) List the conditions which favor cotton culture in Egypt Review cotton production in India, p 154, and China, p 154 (*b*) Why is the Peruvian Desert an important cotton region?

7 Take a small outline map of the world and from Fig 164 and the text trace on it the chief world movements of raw cotton. Put on your map the chief shipping and receiving ports

## TWO EXTRA LESSONS

I "Other Crops in the Cotton Belt" — Fifth exercise above, text, **106** (1921) pp 343–349, **A**, III (1927), 78–83; **87**, pp. 255–263

II. "World Trade in Raw Cotton" — Seventh exercise above, text, **12**, pp 268–271, **4**, pp 14–32, **106** (1921), pp 396–399 In connection with the lesson work out, also, the trade in cotton-seed oil

## READINGS[1]

"General" — **86**, pp. 209–217, **95**, pp 88–95, **23**, pp. 498–516, **94**, pp. 96–102.

"On the Cotton Belt" — **12**, pp 271–282, **4**, pp 9–12, 76–88, 91–93, 106–114, 131–136, 137–144, **20**, I, pp 127–135; **2**, I, pp 60–67, **B**, XXIX (1930), 141–147, **7**, I, Chapter XVII, **1**, pp 60–79; **106** (1921), pp. 338 ff, **A**, III (1927), 65–86, many pictures and maps, **87**, pp. 237–266

"The Story of Cotton" — **62** and **66**.

"Cotton in Egypt" — **4**, pp 47–48, **23**, pp 509–510, **A**, IV (1928), 306–309, **106** (1921), pp 325–330; **86**, pp 434–436

"Cotton in Peru" — **75**, pp. 205–208, **17**, pp. 189–192, **A**, III (1927), 507–523; **J**, XXII (1932), 254–256.

"Cotton in Brazil" — **75**, pp 112–113; **17**, pp 452–453, 475–477, 482.

"Cotton Regions of the World" — **66**, pp. 198–200.

## TOPICS FOR INVESTIGATION AND REPORT

"History of Cotton Culture" — **21**, II, pp. 89–123; **66**, pp 1–2, 201–213; **62**, pp 39–50

"Influence of Cotton Gin upon Cotton Culture" — **4**, pp. 59, 137–138, 140–144, 170; **21**, II, pp. 111–114; **86**, pp 209–210, **70**, p 110, **106** (1921), pp. 372–374; **29**.

"The Westward Movement of Cotton Growing in the United States" — **B**, XXIX (1930), 215–219; **106** (1921), pp 330–335.

[1] Numbers and letters refer to Selected References on pages 420–424

"The Effect of the Boll Weevil upon Cotton Culture in the South" — 106 (1905), pp 193–218, 106 (1921), pp 336–338, 343–346, 86, pp 215–217

"The War Waged Against the Boll Weevil" — 4, pp 115–124, 106 (1920), pp 241–252, 106 (1901), pp. 369–380, 1, pp 68–70; 87, pp 254–255, 66, pp 116–130, 62, pp 325–328

"Other Enemies of Cotton" — 4, pp 126–129, 106 (1921), pp 352–357, 66, pp 134–142

"Crop Combinations in the Cotton Belt" — 106 (1921), pp 343–349, A, III (1927), 78–83, 87, pp. 255–263

"By-Products of the Cotton Plant" — 4, pp 177–186, 106 (1901), pp 285–298, 2, I, pp 65–67, 86, p 217, 24, pp 317–319, 106 (1921), pp 374–376, 399–400, 62, pp. 352–379

"Life in a Cotton Farming Community" — B, XXIX (1930), 141–147

"The Method of Growing Cotton in Peru" — A, III (1927), 512–516.

"The Expansion of Cotton Culture into New Regions" — A, V (1929), 335–347.

"Peanut Production in the Cotton Belt" — A, VII (1931), 59–68, 33, No 8, pp 3–14.

"The Parts of the Cotton Plant" — 66, pp 16–24.

## § II — CORN AND MIXED FARMING

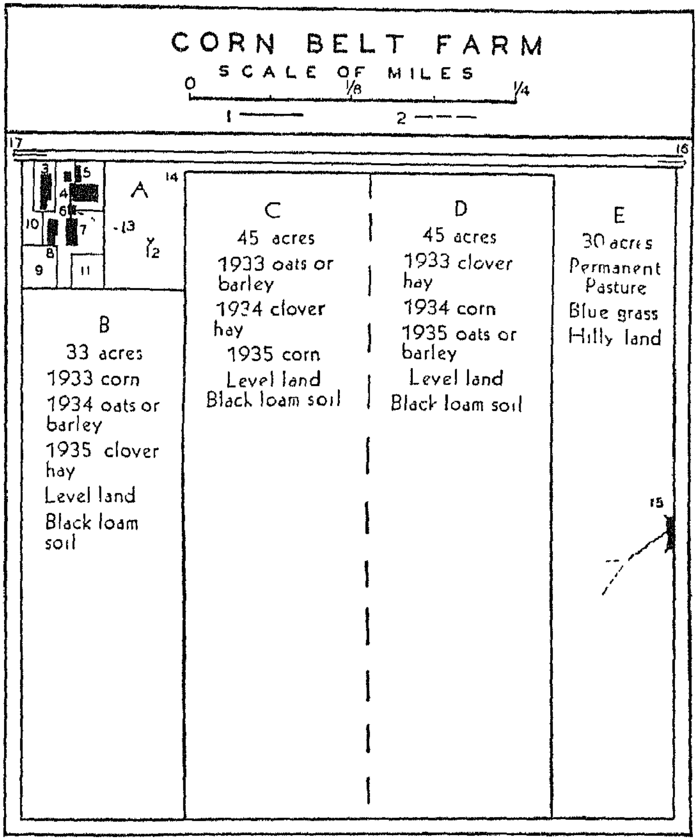
**Mixed Farming in the Corn Belt.** As a class the farmers in this group are among the rich farmers in the world In no other large agricultural region do so many farmers have large farms, comfortable homes, good roads, and fine schools The people in this area have reached this stage because they are excellent farmers and because they have the innumerable advantages which mark the corn belt as one of the world's finest farming regions.

### LIFE ON A CORN-BELT FARM IN ILLINOIS

**A Visit to the Jones Farm.** Let us visit the Jones farm (Fig. 165). This farm, located in western Illinois, is typical of thousands of corn-belt farms

As the train stopped at Oneida, Mr. Jones was waiting with his car. We received a hearty welcome and got into the car. On the way to the farm we noted that every mile there was a corner at which roads run north, south, east, and west The country is so flat that the roads are laid out at right angles to each other and cross at one-mile intervals. The barking dog announced our arrival, and Mrs Jones was outside waiting when we came into the yard The house was well painted and when we entered we were surprised to see that the large eleven-room house looked about the same inside as most well-kept city houses It had running hot and cold water, baths, toilets, a furnace, telephone, radio, and other modern conveniences.

As we arrived at twelve o'clock, Mrs Jones had dinner ready, consisting of fried spring chicken, rich milk and cream, fresh butter, vegetables, pies, and relishes — what a dinner! With the exception of such things as coffee, salt, pepper, and sugar, everything was raised on the farm After dinner we started out to look over the farm. The big red barn, used for cattle and horses, dominated the other buildings (Fig. 166). The size of the hog house indicated that Mr. Jones raised many pigs. He explained that he always weighs his hogs and beef

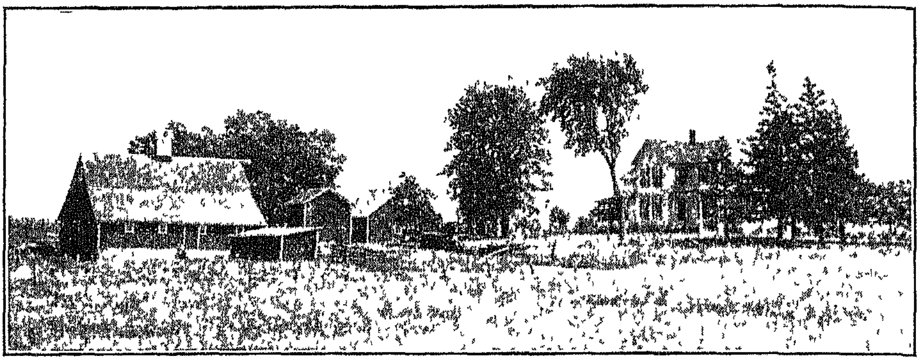



JONES CORN-BELT FARM, KNOX COUNTY, ILLINOIS

Fig 165 1, Fences 2, Unfenced land and field borders 3, House 4, Barn 5, Hog house and scale house 6, Cement watering tank. 7, Corn crib and granaries 8, Tool shed and chicken house 9, Chicken and calf pasture 10, Garden and orchard 11, Garden 12, Windmill 13, Underground water pipe 14, Lane to pasture 15, Cement dam and watering place 16, Road, two miles to Oneida, a railroad town 17, One-half mile to cement road and four miles to Wataga, a railroad town How many acres in the farm? In a given year how many acres in corn, oats and barley, hay land? Why are crops so evenly distributed? Field E pastures about twenty head of stock; field A the work horses and cows at night

cattle in his scale house before sending them to market. The corn crib and granaries indicated that most of the crop he raised could be stored on the farm until used or sold A windmill, a water tank, and a tool shed were a necessary part of his equipment. His chicken house was large, for Mrs. Jones kept two hundred chickens (Fig. 167). We realized then the source of the spring chicken we had for dinner, and a little later where the potatoes, beans, lettuce, and tomatoes came from, too, for we saw two gardens and an orchard

By four o'clock, as we were hot and tired, Mr. Jones took us to the house for some cold buttermilk. Although only the middle of June, the day was hot and sultry. We thought the



THE JONES FARM

FIG 166 A modern corn-belt farm represents a large investment and is a busy place throughout the year The granaries, tanks, and feeding bunks are back of the barn, see map, page 199

weather disagreeable, but Mr Jones didn't complain, he said that bright, hot, sunny weather was the best kind for his corn.

At four-thirty we decided to see more of the farm Mrs Jones stayed home for she had to get supper, feed the chickens, and gather the eggs. As we started north towards the corn field, Mr Jones explained that his farm contained 160 acres, or one-fourth of a square mile, which was an ordinary sized farm for most any part of the corn belt. The land is level except for a strip on the north kept in permanent pasture When we came to the corn field where the hired man was cultivating, Mr Jones dug his shoe into the black loose soil and said that he had never realized what fine soil he had until he took a trip east through New England and the Atlantic coastal plain where the soil is rocky, thin or sandy, and often infertile. Mr Jones usually plans to have approximately one-third of his crop land in corn He explained that while his corn, used chiefly for hog and cattle feed, was the most important crop, he also had oats or barley, and hay each year The oats are used for horse feed while the hay is used for both horses and cattle in the winter

Oats are seeded early in the spring before corn is planted and are harvested just after corn cultivating is over Also oats act as a third crop in the rotation scheme. Crop rotation, or the planting of different crops on the land each year, is practiced so as to keep the land as fertile as possible The oats, following corn, act as a nurse crop for clover seed planted with it The clover hay crop furnishes feed for stock, but besides that, clover being a legume, adds nitrogen to the soil and thus makes the next year's corn crop grow better. In the north pasture were twenty young steers and six cows Mr Jones drove the cows home ahead of us, he said that he kept only enough milch cows for his own use When we reached the yard, the hired man had fed the horses, and was feeding the hogs — one hundred young pigs that were born in February and would, with plenty of corn feed, weigh two hundred pounds each and be ready for market in the fall. At the yard gate we met Mrs.

Jones with a basketful of seventy eggs she had gathered Supper was on the table.

**A Year's Work on the Farm.** Because of our genuine interest and persuasion, Mr Jones promised to tell us

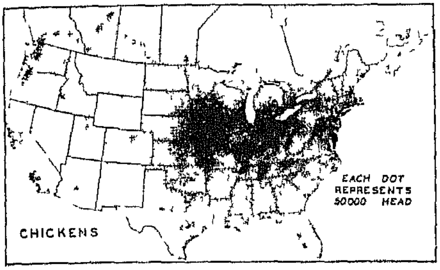
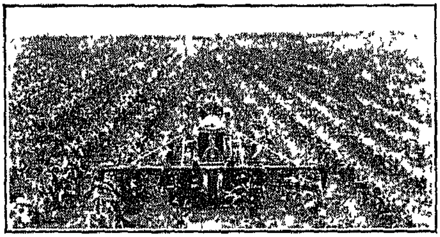



FIG 167 More than half of the chickens of the country are in the corn belt and around its margins where food is cheap Why are there so many chickens in eastern United States?

of a year's work on his farm. Since we had just seen his crops growing, he decided to start with this year's crop, tell us what he had done so far and what he planned to do before next spring

Spring comes rapidly, the change in temperature from February to March is great (p. 189). Rainfall increases also. Mr Jones' first spring work was to finish plowing the forty-five acres in field B that had been in clover the year before. He was not able to get into the field as early as he expected because of the rather rainy weather which made the ground too wet to plow After the plowing was finished he disked field C, which had been in corn the year before, for which reason the soil was so loose that plowing was not necessary (p. 101). Disking goes about three times as fast as plowing, so he saved considerable time. Early in April he planted field C to oats. He planted clover with the oats. The clover was to be the hay crop of the next year. In field D the clover hay was green, it had been planted the spring before with the oats crop On May 5 he started to harrow the corn field and by May 10 had started planting corn The corn could not be planted until danger of frost was past, but it had to be planted soon enough so that it would mature before the first fall frost The corn was checkrowed in such a way that it could be cultivated from north to south and east to west This made it much easier to kill all the weeds with a cultivator

With June came more rain and hotter weather The rainfall was of the thundershower type so that there was still a large amount of sunshine Many times the rains come at night allowing the sun to shine all day Hot days and nights are excellent for corn Three or four cultivations are necessary (Fig. 168). Mr Jones said that



*Courtesy of International Harvester Company*

FIG 168 CULTIVATING FOUR ROWS AT ONE TIME

by the Fourth of July he would finish cultivating because by that time the corn would be too big to cultivate and would shade the ground enough to keep down the weeds With his corn "laid by," he felt free to celebrate the Fourth Making hay comes during the cultivating season and, unless interrupted too often by wet weather, all the hay is usually put up and corn cultivated without trouble. Mr. Jones plans to harvest his oats about the mid-

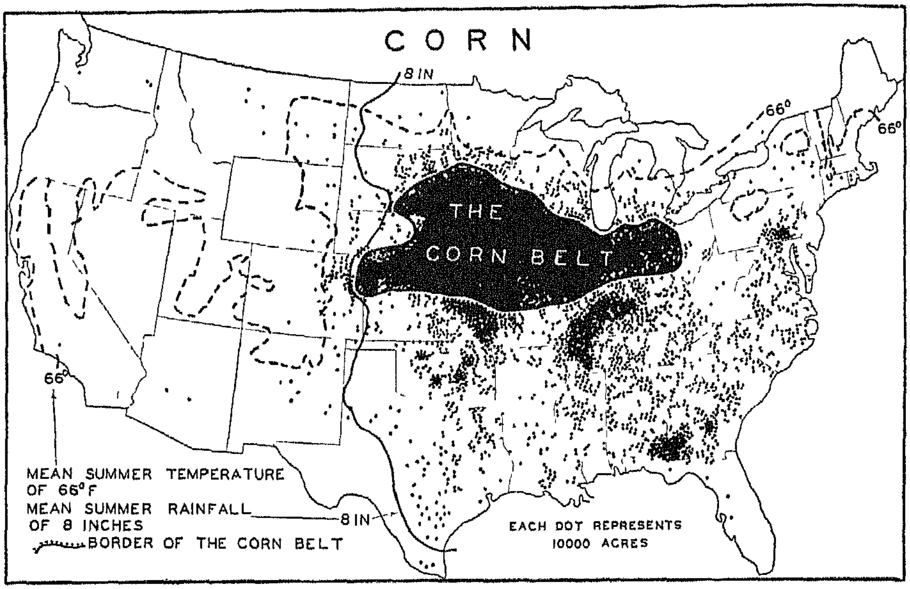
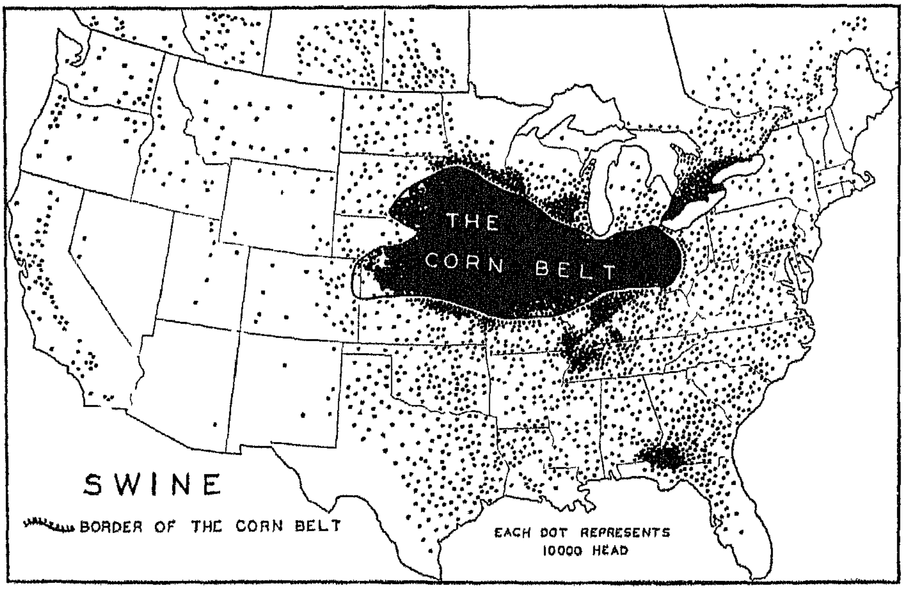



FIG 169 About one-half of the corn of the United States and one-third of the world's crop is produced in the corn belt What limits its production in the north? What three conditions limit it in the west? What are the uses of corn grown north of the corn belt? Why is corn an important crop in the cotton belt? About one-fourth of all our crop land grows corn




SWINE AND THE CORN BELT

FIG. 170. Nearly sixty per cent of the swine in the United States are in the corn belt, 15 per cent are in the cotton belt Why are there so many swine in the western part of the dairy belt and so few in the eastern part (pages 218–221)? Why are there so many swine in Canada northeast of the lakes? Which of these areas produces the lard hog? The bacon hog?

dle of July, then as soon as a threshing machine comes he will in a day or two have it in his granaries.

With the approach of fall the temperatures, although still high in the daytime, will be low at night, causing the corn to begin to mature In October or November Mr. Jones will go into the field to pick his corn (p. 101). He will sell the twenty steers that he has fattened during the summer and buy about twenty-five western range cattle to fatten during the winter for the February market (p 377). By November the hogs will be sold and if the price of pork is high, he may buy or raise fifty more hogs to feed through the winter.

The winter will be cold with many snowstorms The cattle, hogs, and chickens must be cared for, which will mean the hauling of a great deal of feed from the cribs, seeing that the stock is provided with plenty of water, cleaning barns and chicken coops, and hauling the manure onto the land for fertilizer. On many cold, stormy days he will take the children to school and go after them. With all this work, Mr. Jones still has much time to read and listen to the radio during the winter, pleasures for which he has little time in summer, for after a long day's work he is so tired that he is ready to go to bed soon after supper. After February 1 a great deal of extra work will come, for then the little pigs will be born and during the cold months will require much care. The last part of February Mrs. Jones will start her incubator which will hatch two hundred or more little chickens. Then spring will come again. The people who think that the prosperous corn-belt farmer isn't busy all year have never lived with one.

## THE CORN BELT OF THE UNITED STATES

**Factors Determining the Limits of the Corn Belt.** Though corn covers a vast area in the United States, yet the region in which conditions for corn cultivation are so favorable that it is the most important of all crops is limited (Figs 169 and 170). To the north of 66 degrees Fahrenheit mean summer temperature, the production of corn becomes low On the west the corn belt is limited by less than eight inches of rainfall during the summer months or about eighteen inches for the year. On the south in Ohio, Indiana, and Illinois the corn belt ends where the rich glaciated soils stop and the poor non-glaciated soils begin In Missouri it is limited on the south by

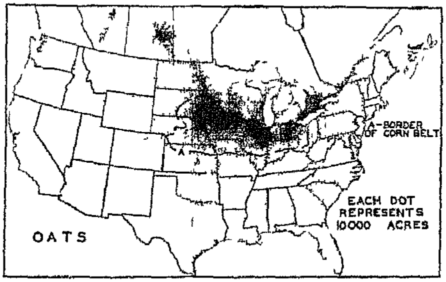



FIG 171 The great oats region of North America extends in a crescent from Quebec through the northern part of the corn belt to Alberta, Canada Oats need a cool moist climate Give four reasons why oats are a very important crop in the northern part of the corn belt What crop takes the place of oats in the crop system in the southern part of the corn belt?

the poor hilly soil. In Kansas where the hot winds of July and August dry up the silk and pollen of the corn, the yields are low and as a result corn is grown only to a limited extent. In the east, the level fertile limestone soils of Ohio give way to hilly, infertile clays and shales and the corn acreage decreases.

**Relative Importance of Other Crops.** Although corn in the corn belt is the outstanding crop, yet it occupies less than half of the cultivated land Of the other crops, oats (Fig 171) and hay are important in the north, and wheat and hay in the south Oats and hay are used chiefly for stock feed while wheat is a cash crop Vegetables of all types and fruits including apples, peaches, pears, plums, and many cherries as well as bush fruits such as blackberries and raspberries are grown for home use.

## CORN IN OTHER LANDS

**Wide Distribution of Corn Production.** Although corn yields best under the almost ideal conditions of the corn belt, yet there is no other major food crop which will give more satisfactory returns under adverse conditions Corn was not brought to the attention of the civilized world until the latter part of the fifteenth century when Columbus found the Indians of the New World using it He took some of it back to Spain and from that time it has spread and is still spreading to many parts of the world. It can be found in every continent, in North America reaching as far north as Canada and as far south as Panama. It will grow from Colorado with only fifteen inches of rain per year to parts of Brazil with more than one hundred inches It is found from the level lands of the corn belt to the steep mountain slopes of Mexico, from the rich black loam soils of Iowa to the infertile sandy soils of Florida or the rocky soils of New England. It is used and cultivated by the negroes of Africa, the Indians of North and South America, the orientals of China, the Hindus of India, and the whites of Europe, North America, and South America It has been the staff of life of the American pioneers and is today the mainstay of the corn-belt farmer. It is grown today by farmers of Mexico having only a hoe and crooked stick plow for implements, and by the farmers of the United States with steel plows, disks, harrows, planters, cultivators, binders, shredders, and huskers. It will grow if the kernels are merely dropped in a hole in the ground, covered, and left to mature, though it will grow much better if carefully planted on well-tilled ground It has innumerable uses, from the food of man and beast to its use for glue on postage stamps It is used in the corn belt for fattening hogs, cattle, and chickens, in Argentina for export, and in tropical countries as human food All parts of the plant are used, leaves, stalks, ears, and cobs. Among the more important by-products of the corn plant are corn syrup, corn starch, face powder, glue, dyes, shoe polish, iron moulds, soap, axle grease, paints, varnishes, salad

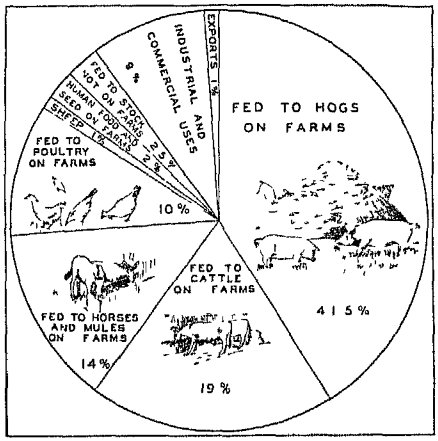



FIG 172. How the corn crop of the United States is used, see the maps on pages 65, 96, 201, and 220

oils, rubber erasers, tires, alcohol, writing paper, and even corn-cob pipes. Thus corn is a very useful plant (Fig. 172).

**Subsistence Corn Production in Brazil.** Corn production in southeastern Brazil differs greatly from that of the corn belt not only in methods

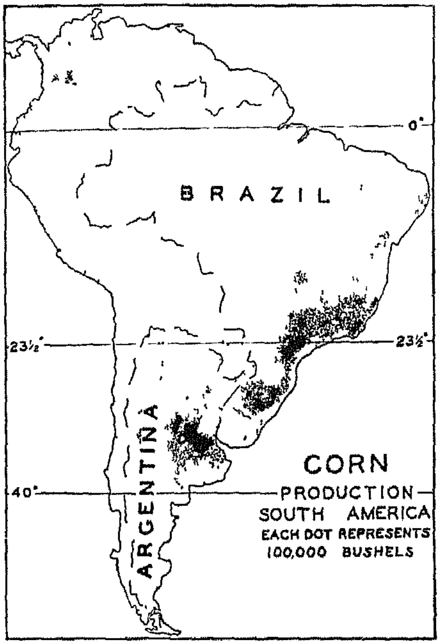



FIG. 173. Brazil and Argentina produce most of the corn of South America, Argentina supplies nearly two-thirds of the world's exports of corn. On page 86 note that the corn regions of South America do not have most of the cattle. Explain why this is so.

of cultivation but also in use made of the corn crop (Fig. 173). Corn in Brazil grows under hot humid conditions, the rainfall in certain portions being much heavier than in the corn belt of the United States. The people raise the corn for home use, making it directly into a flour. Many grow it by crude methods of cultivation consisting of scratching the dirt with a crooked stick, planting the corn, then hoeing it a few times by hand, while others grow it like the farmer of the corn belt. Brazil raises much corn but most of it is used for food for its millions of people who do not grow wheat, barley, or oats, and only a little rice, thus corn is their chief cereal food. This corn is soft and will not ship well, so Brazil does not export corn as Argentina does.

**Commercial Corn Production in Argentina.** In direct contrast to production in Brazil, Argentina raises corn under conditions not greatly unlike those of the corn belt. The region of production in Argentina is in the pampa. Rainfall and temperature are favorable for the production of a small-grained flint corn, excellently suitable for shipping to Europe where it is used for cattle, hog, and chicken feed. Because of cheap production and nearness to the sea, Argentina is able to hold her European market successfully against the United States. Methods of cultivation similar to those of the United States keep cost of production low, and a careful selection of seed and fertile soil make yield and quality of corn fairly high.

**Corn in Southeastern Europe.** Second in importance to the American corn belt in total production is the area stretching from the Po Valley to southwestern Russia and from Hungary to Bulgaria. In all, these lands produce about one-sixth as much as the United States. Conditions of soil, rainfall, and temperature closely resemble those in the corn belt, but here as in almost every corn region outside of the United States and Argentina corn is an important food for the people. A considerable quantity also is fed to stock or exported from each country, except Italy.

### WORLD PRODUCTION AND TRADE

The United States produces more than three times as much corn as wheat, yet our wheat export is ten times as great as our corn export. The world production of corn is greater than that of wheat, yet the world trade in wheat is three times as great. The explanation for this unusual condition is based on two factors. First, the value of corn per unit of weight is much lower than that of wheat and hence cannot as easily bear the cost of transportation. Second, corn is in many areas a stock food, wheat everywhere a human food, which means that the corn can be fed to stock and the stock sent to the market cheaper than the corn can be shipped because it takes five pounds of corn to make a pound of pork and ten pounds of corn and ten pounds of hay to make a pound of beef. In addition, most corn has a high percentage of moisture and unless kept dry it spoils while being shipped. It is also significant that the United States, which produces two-thirds of the world's corn, has her area of concentration far from the sea and hence far from cheap ocean transportation. Argentina supplies about two-thirds of the world's corn exports.

## EXERCISES

1. (*a*) In table form contrast the size, fields, buildings, and crops of the Darkenwald spring wheat farm of North Dakota (p. 178) with the Jones corn-belt farm of Illinois. (*b*) Make a list of the machines each of these farmers uses.

2. (*a*) In 1934 how many acres of each crop did Mr. Jones have? (*b*) Why do oats or barley follow corn and clover follow oats in the rotation system?

3. (*a*) Which can the farmer ship more economically — hogs or corn? (*b*) Why? (*c*) In a year's time about how many hogs, cattle, and chickens does Mr. Jones sell?

4. (*a*) Why doesn't he sell most of his grain? (*b*) Give four reasons why Mr. Jones raises so much hay.

5. Outline the work Mr. Jones does in each of the following seasons: (*a*) spring, (*b*) summer, (*c*) autumn, (*d*) winter.

6. (*a*) What is the corn belt? (*b*) Answer questions under Figs. 169, 170, 171, and 188.

7. (*a*) Why is corn ever grown in rugged mountain areas? (*b*) In the hot humid tropics by negroes and Indians? (*c*) Give six ways corn products are used as food. (*d*) In what other ways is corn used?

8. (*a*) How does corn production of southeastern Brazil differ from that in the corn belt? (*b*) List four or more reasons why Argentina is able to ship about two-thirds of the world's exports of corn.

9. Give several reasons to explain why world trade in corn is so much smaller than world trade in wheat?

## READINGS [2]

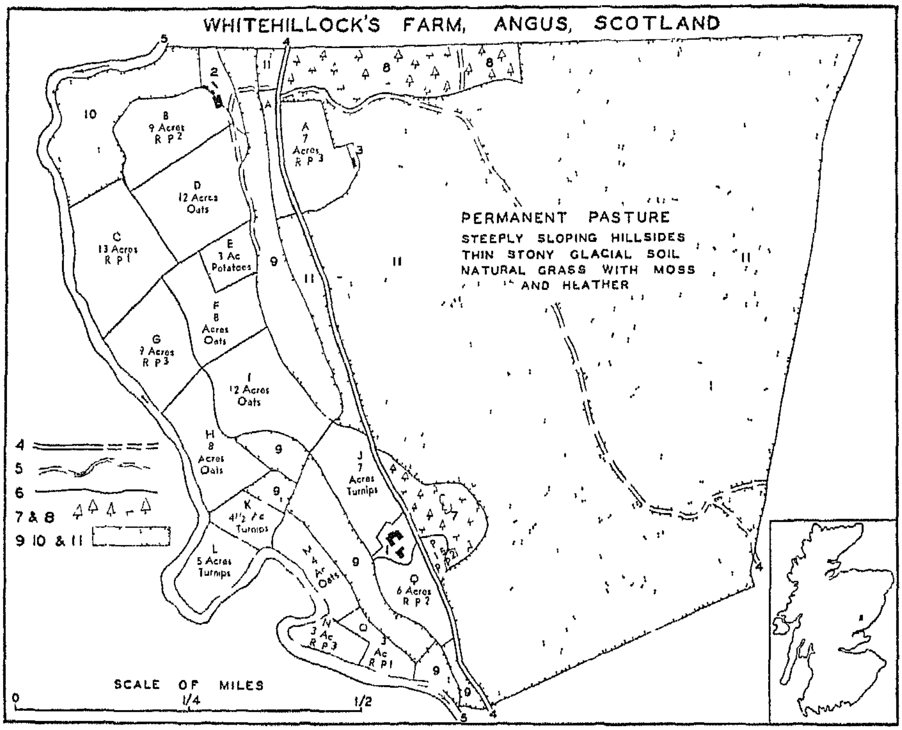
"The Corn Belt" — A, III (1927), 447–465 (excellent pictures); 7, I, pp. 224–232; 87, pp. 290–302; 12, pp. 257–266; 1, pp. 5–22; 9, Chapter VI; 7, I, Chapter XXX; 3, pp. 170–194.

"An Illinois Corn Belt Community" — B, XXXII (1933), 1–15.

"Fattening Steers in the Corn Belt" — 101, No. 1382.

"Geography of Corn Production" —

[2] Numbers and letters refer to Selected References on pages 420–424.




*Drawn from information supplied by Catherine P. Snodgrass*

WHITEHILLOCK'S FARM, GLEN CLOVA, ANGUS, SCOTLAND

FIG 174 1, House, barn for cattle and sheep, sheds for hogs and chickens and implements 2, Feed barn and bunks 3, Sheep shed and feed lots 4, Roads 5, South Esk River 6, Stone, hedge, and wire fences 7, Scots fir, larch, and spruce planted as wind break 8, Scots fir, wind break, timber used for fencing 9, Permanent pasture on marsh land 10, Permanent pasture on sandy, gravelly soil 11, Permanent pasture on rough highlands What per cent of the land of Scotland is in rough hill pasture (page 93)?

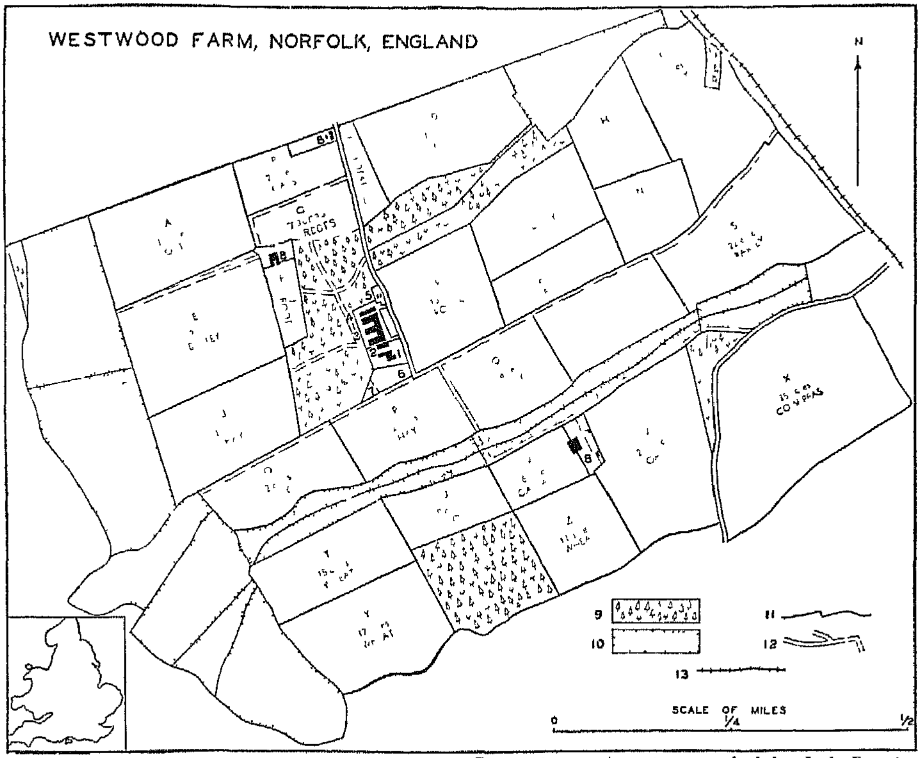
The farm contains 525 acres, 385 5 acres are in permanent pasture (why?), 22 acres are in woodlots (why?), 5 5 acres are in the farmstead and lots How much of the farm is arable? In a given year the land is used as shown, what per cent of the arable land is in oats? In turnips? In rotation hay and pasture land (RP)? Hay is cut from fields in the summer and they are pastured in winter Three acres supply the potatoes for the family and hired help, near the house is a garden of vegetables, gooseberries, black and red currants, and strawberries

The farmer employs four men and two women laborers He uses four work horses and plowing, planting, reaping and threshing machinery His farm carries 50 head of cattle and from 250 to 300 head of sheep of the black-faced mountain breed Why is so much land used for permanent and rotation pasture? Explain the location of the arable land What is the name given to the rough hill pasture (page 92)?

ture, repairs harness and machinery, and provides his firewood.

To keep up the fertility of his land, he uses much manure and a six-year rotation system as follows:[3] first year, oats; second, turnips or potatoes; third, oats; fourth, RP[1] first year hay and pasture, fifth, RP[2] second year hay and pasture; and sixth, RP[3] third year hay and pasture. The seventh

[3] RP[1] means fallow land in first year pasture, RP[2] second year pasture, RP[3] third year pasture




*Drawn from information supplied by Jack Brereton*

WESTWOOD FARM, NORFOLK, ENGLAND

FIG. 175 1 House and yard 2, Poultry yard and house 3, Horse and cattle barn 4, Tool shed 5, Sheep and hog sheds and feed lots 6, Garden and orchard 7, Apiary 8, Field barns, feed bunks, and lots 9, Woods 10, Permanent pastures 11, Hedge and wire fences 12, Roadways. 13, Railway The inset shows the location of the farm in England

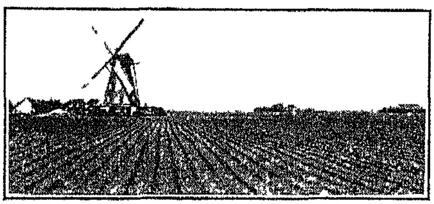
The large farm of 520 acres has 10 acres in the homestead and lots, 53 acres in woods, 107 acres in permanent pasture How many acres are farmed? Cabbage, wheat, and about half the barley are grown for sale — wheat for flour and barley for malt The other crops are grown chiefly for feed for cattle, sheep, and swine Including the pasture what per cent of the entire farm produces feed for the stock? Mr. Joice, the farmer, plans to sell each year 350 fat lambs, 100 fat cattle, 400 fat hogs, several hundred chickens, the wool of 260 ewes, the eggs of 300 hens, and the milk of 30 cows Mr Joice does not raise all these on his farm, he buys, for fattening, some sheep and cattle from the highlands of England and cattle from Ireland, he also buys hogs for feeding To work this farm Mr Joice has sixteen work horses, a tractor and all kinds of machinery, including a threshing machine and feed grinder He hires sixteen workers over twenty-one years of age and eight under twenty-one Mr Joice has a big job to run his farm at a profit

year the rotation starts again with oats. The farmer keeps the percentage of land in oats, turnips, and RP about the same year after year by using rotation in fields A to Q.

**Westwood Farm, Norfolk, England** (Fig. 175). This farm, located in the eastern plain of England, is in one of the most intensively farmed sections of Europe. The gently rolling land, clay loam soil, absence of excessive rain, and nearness to large market

centers give Mr Joice a chance to raise and sell a variety of products Every season is a busy one. The work of spring consists of caring for the baby lambs [4] and pigs, fattening cattle and hogs and marketing them, cleaning out the feed lots, spreading manure, working down the land and planting the oats, barley, peas, beans, new hay, cabbage, and early roots

In early summer the hay, peas, and beans are cut, cured, and stored in barns or stacks, in late summer the wheat, barley, and oats are cut and threshed, the late roots are planted, some of them on the winter barley and wheat fields, the root crops are hoed and plowed (Fig 176), and the stock grazed on the permanent pasture and stubble fields. In the autumn the wheat and some winter barley are planted, some white turnips are pulled, washed, and marketed, the



*Courtesy of Swedish State Railway*

MANGELS IN SOUTHERN SWEDEN

FIG 176 The young tender plants require several hoeings and plowings before they are large enough to shade the ground and keep down the weeds

cabbages are cut and marketed; some of the swedes and mangels (big forage beets) are pulled and buried in pits, the ewes, cows, and young cattle are grazed on pasture, the hay stubble, and on the tops of the roots, extra cattle and swine are bought for fattening; the fattening stock are fed in

*Courtesy of Buchtruys Maskinfabrik*

MANGEL-WURZELS IN DENMARK

FIG 177 The implement in the upper picture cuts the tops off the mangels, lifts them out of the ground, and cuts off the roots, root lifting machines are used in many sections, but most of the roots of northwestern Europe are pulled by hand, this is true also of all the turnips, carrots, radishes, and other roots produced for sale in the cities In the lower picture the piles of roots will be covered with straw and dirt to keep them for winter feeding

lots on ground feed; and the fall plowing is done. In winter the remainder of the roots are pulled and marketed, or stored for feed, the fall plowing is finished (p. 224), hedges are cut, in spare time laborers cut firewood, ewes and young stock are grazed on stubble and root fields, fat stock are fed carefully in lots Throughout the year cows, bees, and chickens are tended carefully. No farm has more types of work than one on which mixed farming is practiced

On all the fields a four- or five-year rotation system is used so as to keep the land fertile and save labor in plowing and working the soil. The order of crops in the system is as follows: first, clover, fodder hay, and pasture; second, wheat; third, root crops and potatoes; fourth, oats or

[4] The lambs are born in February and March; during lambing time a shepherd must stay up each night with the sheep

barley, and fifth, barley. In general the farmer grows each season about the same acreage of each crop for three reasons to have an even labor supply and stock carrying capacity, to maintain a crop rotation system, and to get an income from several crops and animal products

**Root Crops and Animals.** Northwestern Europe produces no corn However, turnips, mangel-wurzels, and other forage beets are well adapted to the cool moist climates, sandy soils, and dense populations of this region The tops can be grazed by sheep and cattle in late summer, fall, and winter, and the roots, which contain more food value per acre than corn, are fed in winter to horses, beef cattle, ewes, lambs, swine, and dairy cows (pp. 91 and 213 — see picture p. 212)

The British Isles, northwestern France, and southern Scandinavia lead in the production of these valuable crops About 10 per cent of the crop land in the United Kingdom is in turnips. In Denmark, turnips also have an important place in the remarkably productive animal industries, but mangel-wurzels have a higher rank The two occupy about 15 per cent of the land in crops (Fig 177). In Germany the overwhelming position of potatoes even as feed for livestock makes turnips and forage beets of less importance.

The dense populations, the climate favoring root forage and grass, together with great skill on the part of its farmers give parts of northwestern Europe the greatest density of large domestic animals in the world The Irish Free State, for example, has about 150 cattle to every square mile, against 70 per square mile in Iowa (Fig 178) In the United Kingdom the density is not so great, but as a group the beef cattle are the finest in the world Almost all of the best breeds of beef cattle were developed in Britain This region also is credited with the best breeds of dairy cattle and most of the finest types of sheep In Germany, Holland, Belgium, and Denmark the pig industry

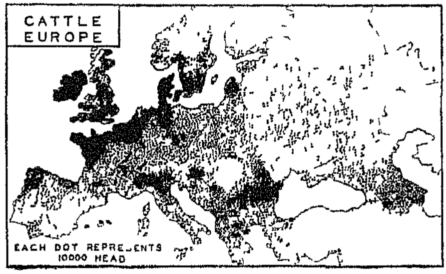



FIG 178 Northwestern Europe is a great beef and dairy cattle region A humid cool climate, many rough and marshy areas, intensive mixed farming, dense population, and excellent transportation favor the production of cattle products

has reached a high development, the animals thriving on beets, turnips, potatoes, barley, and dairy by-products.

Most of the animals are raised for local consumption, but in two countries the fact that climate and soil are unfavorable to food crops makes animals especially important Denmark and the Irish Free State depend upon animal products for their main exports, in both cases the bulk going to England Almost one-third of Denmark's export trade is made up by bacon, regarded as the world's finest, and another third by butter. Almost one-third of the Irish Free State's exports consist of live cattle shipped to England for fattening.

**Potatoes and Mixed Farming.** Potatoes are of special significance to

northwestern Europe. In the United States potatoes are grown on about 3,500,000 acres, or 1 per cent of the cultivated area. Germany, with only one-seventh as much arable land as the United States, has 7,000,000 acres of potatoes, or 15 per cent of its cultivated area. This is one-fourth of the world's potato production. In Poland potatoes also hold 15 per cent of its cultivated area, producing another one-fifth of the world's supply (Fig. 179). Europe as a whole produces four-fifths of the world's potato crop. Why does Europe grow so many potatoes?

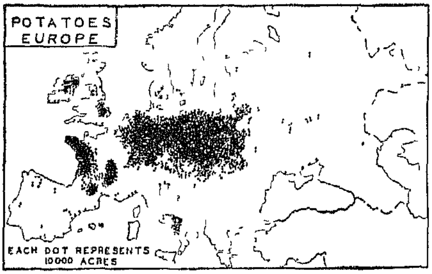
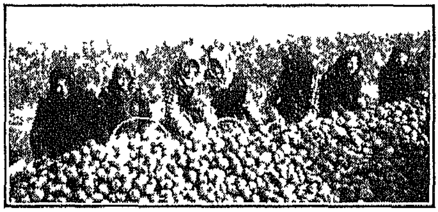



FIG 179 Locate the great potato area of Europe on a political map. Can you give reasons for so many potatoes in this region? Why are so many potatoes produced in western and southern France?

The potato is one of the most productive crops grown in temperate lands. Although it is only one-quarter as nutritious as wheat, one acre of potatoes will produce from five to ten times as many bushels of food as an acre of wheat. Hence it is a valuable crop in densely populated Europe (Fig. 180). The potato is one of the hardiest of cultivated plants, growing to perfection only in regions of relatively cool climates. In the United States the largest yields of 250 bushels per acre are in Maine, whereas the average for the country is only 110 bushels. As the most populous part of Europe lies even farther north than Maine, a hardy crop is important. Much of northern Europe has rather poor soils and the land has been cultivated for a long time. This is less of a handicap in raising potatoes than would be the case with most crops. To grow potatoes huge quantities of fertilizer are necessary, but this is justified since the crop yields more food than any other. Potatoes require much labor and are so bulky that it generally does not pay to ship them very far. Northwestern Europe has an abundance of low-priced labor and a fairly even distribution of farm population as well as many large cities.

As a result of these favorable conditions, Germany produces 24 bushels of potatoes per capita, six times as much per person as the United States produces. In Germany potatoes are used in many ways. Less than a third are used directly for human food, although the Germans eat about four times as much as the average American. The principal use is livestock feed, especially for hogs (Fig. 181). In addition large quantities are used in the manufacture of alcohol, starch, and potato flour.



*Courtesy of German Tourist Information Office*

SORTING POTATOES, GERMANY

FIG 180 Throughout northwestern Europe women take an active part in the planting, cultivation, harvesting, and preparation of the crops. The potatoes are being sorted according to quality and uses to be made of them.

**Sugar Beets.** The sugar beet in the agriculture of northwestern Europe holds a distinctive place. It supplies a large part of the sugar requirements

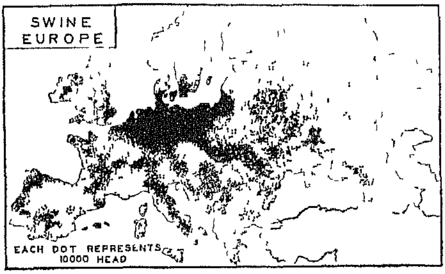



FIG 181 The great swine regions of northwestern Europe are in the regions of root crop mixed farming and of dairying Contrast with the sheep map, page 91, and explain

of the people and is the basis for important sugar manufacturing enterprises, it constitutes an indispensable part of the animal industries as beet tops and root refuse, after the sugar has been extracted, make fine feed for livestock, it is rotated with cereals As a result of its importance to both man and animal the sugar beet occupies the best lands of this area. It finds, in addition to suitable climatic and soil conditions, the dense population required for working in the fields, good transportation facilities, and large markets

Germany, France, and Czechoslovakia have the leading sugar beet areas (p 111), Germany being the world's main producer. Here the industry is concentrated in two districts which have a fertile, dark-colored, fine-textured loamy soil, relatively high summer temperatures, and comparatively low rainfall.

**Cereals and Mixed Farming in Northwestern Europe.** Although root crops are a distinctive phase of agriculture in northwestern Europe, grains have an important place, the acreage generally exceeding that in root crops These are valuable because they add variety to the diet, fit into crop rotation systems, and require less labor than the root crops

Some of the best soils of this region generally are sown to wheat Five centers stand out western France, northern France, southwestern Belgium, eastern England, and central Germany (Fig 182). The skilful farmers of northwestern Europe secure enormous yields, because of fertilization, careful seed selection, and crop rotation Netherlands and Denmark devote comparatively little land

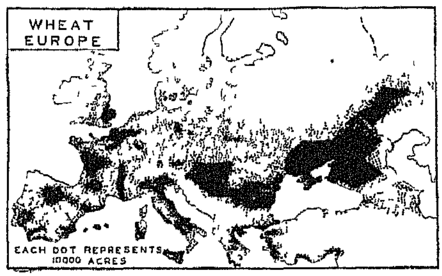



FIG 182 WHEAT IN EUROPE

to wheat but they have average yields of more than 40 bushels per acre. Belgium gets 38 bushels to the acre, Great Britain, 35, Germany, 26, France, 20. How do these yields compare with those in the semiarid wheat regions of the world? Only in France, where the government protects wheat farmers against cheap wheat from semiarid regions by a high tariff, and in Switzerland does wheat occupy more land than any other crop In the other countries of northwestern Europe barley, rye, and oats are the main cereal crops.

The fact that rye, like potatoes, produces good yields in regions of severe winter temperatures, poor soil, or

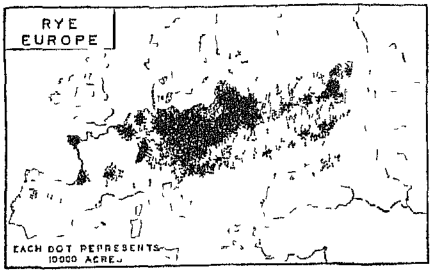



FIG 183 In southern and western Europe wheat takes the place of rye for bread

rough topography makes it a valuable crop for these lands (Fig 183) In the great northern plain of Europe from the North Sea to the Ural Mountains it is the outstanding crop. In Germany it occupies more land than any other crop except hay, about one-fifth of the total In Poland, which is colder, it occupies more than twice as much land as any other crop, about one-third of the total Each of these countries produces more than five times as much rye as the United States. Whereas in this country rye is grown chiefly for animals, only about one-third being used for food, in parts of Europe it is used mostly for bread

Oats is another crop of great value to northwestern Europe because of its ability to grow in cool, moist climates and on a rather poor soil Besides its use as a food in many areas, especially Scotland, it is important in the live-stock industries In all the coolest countries of northwestern Europe it holds more land than any other crop except hay Commonly it is cut as green feed or hay In the United Kingdom, because of the large area of permanent pasture, it surpasses even hay and holds one-fourth of the area in crops In France and Germany it ranks next to the leading bread cereals.

Barley is especially valuable in northwestern Europe because it will grow in a short season, give high yields of grain per acre, fit well into a rotation system, and give valuable stock feed In England and Denmark huge quantities of barley are fed to animals, and everywhere in Europe it is grown for malt

**Imports of Foodstuffs.** In spite of its system of intensive mixed farming, high yields per acre, and great dairy industry, northwestern Europe has to import much food for its millions It is the world's chief importing region for wheat, corn, oats, beef, mutton, pork, fish, butter, and cheese

## EXERCISES

1. (*a*) Answer the questions under Fig 174. (*b*) What is the system of rotation on this farm? (*c*) Take field C and work out the crops on this field for a seven-year period. (*d*) Take the map as shown for the plan of crops for the present year and work out the field plan of crops for next year.

2. (*a*) Answer the questions under Fig 175 (*b*) Make a list of the cash crops; the supply crops. (*c*) In outline form list the work of Mr. Joice in each season.

3. (*a*) List six reasons to explain why roots are valuable crops for northern Europe. (*b*) Show how roots are related to the beef cattle industry, to the rearing of sheep

4 (*a*) What conditions favor the production of cattle products in northwestern Europe? (*b*) Explain why there are so many cattle in the coastal region from southern France to southern Sweden. (*c*) Contrast the dense sheep areas with the dense cattle areas of western Europe.

5 Why does Europe produce four-fifths of the world's potatoes?

6 List five conditions which make swine so important in mixed farming of northwestern Europe

7 (*a*) Why are cereals important in the mixed farming of northwestern Europe? (*b*) Compare the rye, potato, and swine areas of Europe (*c*) Compare cattle and sheep areas

## SPECIAL REVIEW PROJECT

Contrast the methods of wheat production in (1) northwestern Europe and (2) the semiarid plains of Kansas.

## AN EXTRA LESSON

"The imports of foodstuffs by northwestern Europe," consult the text, tables, and maps; in the lesson attempt to bring out (1) the commodities imported, (2) the regions supplying them, and (3) the reasons for the trade

## READINGS[5]

"Rye, the Grain of Poverty" — **L**, II (October, 1932), 13–18

"Lowland and Highland Farms in Scotland" — **B**, XXX (1931), 365–377

"Agricultural England" — **B**, XXVIII (1929), 68–71, **L**, II (November, 1932), 1–6

"Farming in Ireland" — **65**, pp 370 ff.

"Farming in France" — **B**, XXV (1926), 284–286, 287–288, 292–297; **65**, pp 202 ff

"Farming in Holland and Belgium" — **B**, XXIX (1930), 42–50, **65**, pp 276–292, 293 ff

"The Drainage of the Zuider Zee" — **J**, XXI (1931), 574–583; **P**, LX (December, 1932), 14 ff.

## TOPICS FOR INVESTIGATION AND REPORT

"A Trip to a Large Farm in the Lowlands of Scotland" — **B**, XXX (1931), 365–377; in outline form contrast this large lowland farm with Whitehillock's farm

"The Potato in Europe" — **23**, pp. 114–121, **24**, pp. 142–147, 152–153

"Rye in Europe" — **23**, pp 69–72; **24**, pp 70–74.

"Wheat in Western Europe" — **23**, pp 57–61, 65, **24**, pp 41–44, 46; **A**, I (1925), 39, 42–45.

[5] Numbers and letters refer to Selected References on pages 420–424

CHAPTER XVIII

# DAIRY FARMING IN TEMPERATE LANDS

In some ways dairying is the most advanced type of farming It requires more knowledge of agricultural practices and more continuous work than any other type The dairyman must know how to grow good crops of several types, he must have a thorough knowledge of dairy cattle, and in handling the dairy products he must use as much efficiency as an up-to-date factory The dairyman has work on every day of the year, for dairy cattle are expensive and must not be left to shift for themselves (Fig 184)

Besides human skill dairying on a large scale demands certain geographic conditions The skill and geographic advantages are best obtained in three major dairying regions east central North America, northwestern Europe, and New Zealand and southeastern Australia

*Courtesy of International Harvester Company*

A DAIRY FARM, SOUTHERN WISCONSIN

FIG 184 The equipment of a modern dairy farm is expensive Can you name the various farm units shown here? The cows are Holsteins and Ayrshires

## § I — DAIRYING IN EAST CENTRAL NORTH AMERICA

**A Massachusetts Dairy Farm** (Fig. 185) Mr Shaw's farm gives us a good example of how dairying is carried on in New England. The large barn has three floors In the basement are stalls for two work horses, the calves, and heifers. On the first floor are stanchions for twenty-eight milch cows and bins for dairy feed made of bran, cottonseed meal, etc Also on this floor are the garage and the milk house. The third floor is a huge loft for hay Adjoining the barn is the silo with ensilage (chopped green corn) which is excellent feed for cows in winter. The barn is well constructed to keep out the cold, the cows are kept in their stanchions from October to May. If kept warm and quiet they give more milk In front of each cow is a drinking cup with a constant supply of water. Where does the water come from? The milk house, built recently, is excellently equipped to weigh, test, and cool the milk. Cleanliness is an absolute requirement if the dairyman wishes to sell his milk as grade A

**The Dairy Farmer's Crops.** Nearly one-half of Mr. Shaw's farm is in permanent pasture, which is rough, stony, and has trees scattered here and there. The stones for building the many miles of stone fences were taken out

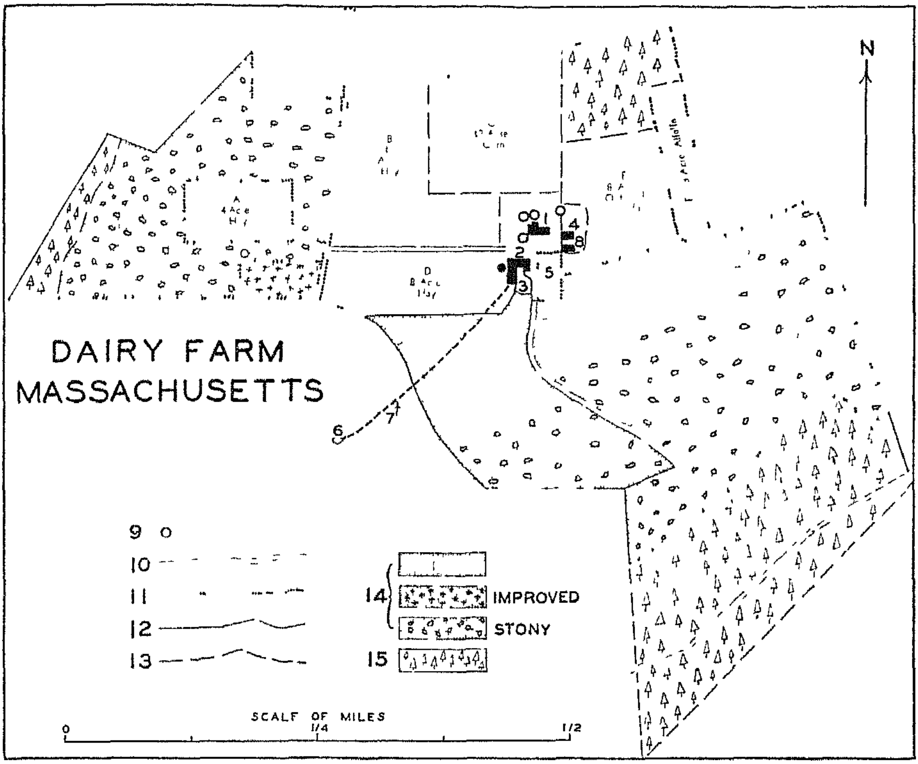



FIG 185 1, House 2, Barn, silo, garage, and milk house 3, Night yard for cows during the summer 4, Garden 5, Orchard 6, Hillside spring 7, Underground pipe line to dairy barn 8, Chicken house and tool shed 9, Wells 10, Roads and lanes 11, Stone-wall fences 12, Wire fences 13, Unfenced field borders 14, Permanent pasture 15, Woodlands

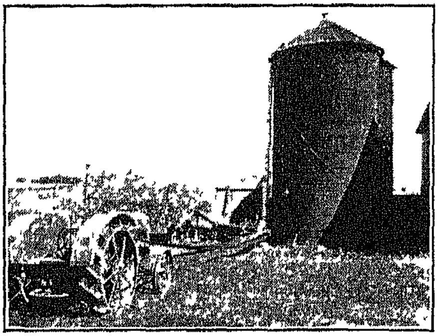
This dairy farm contains 194 acres, 43 acres are in woodland, rough and stony, 96 acres in permanent pasture, all the pasture is rolling to rough land The crop land comprises 50 acres What percentage of the farm is in pasture? In crop land? What part of the crop land is in corn? Mr Shaw produces fruit, vegetables, and poultry for his own use He uses two horses, a tractor, a truck, and other machinery Mr Shaw, his son, and one hired man run the farm They have steady work throughout the year

of the pastures and fields Were you to ask Mr Shaw if he had a hard job building the fences, he would smile and tell you that his ancestors made the fences, but that he has repaired some. These pastures furnish good summer grazing because the region has a plentiful supply of rain. The cows are turned out in daytime about the middle of May, at night they are kept in and fed dairy feed. Nearly all the cultivated land grows crops used for feed for the cows. What part of the crop land grows hay? Physical conditions here are excellent for hay and poor for other crops The land is rolling, soil infertile, climate moist, and the season short. In some years Mr. Shaw plants a field of oats as a nurse crop for grass seeding, he cuts the oats green for hay. Mr Shaw has each year twelve to fifteen acres of corn, which he cuts when still green for ensilage (Fig 186) A large amount

of hay, ensilage, and dairy feed is required because the cows are kept in the barn for seven months and during the summer are fed at night in the barn.

**Well-Bred Cattle Carefully Tended.** Mr Shaw's herd consists of twenty-eight large Holstein cows Each one is a registered pure-bred animal He paid a high price for his cattle, but he says that the money was well spent because the cows produce large amounts of milk In a region where fluid milk is sold, the Holstein is excellently suited, for it produces more milk than any other breed of cattle, though the milk is not as rich as that of others Mr Shaw's cows on the average produce more than three times as much milk per cow as did those of his great-grandfather. Each cow is fed a definite amount of hay, ensilage, and concentrate. The amount is determined by the tests of the individual cow, the weight of the cow, and the milk she produces In cold weather more feed is required to keep the body warm, even though the cows are kept in the warm barn. The water is sometimes heated enough to take the chill off because, if the cow drinks ice-cold water, she must use energy to heat it and hence will give less milk. Each day the cows are carefully brushed and during hot weather are washed. The stalls are cleaned and washed every day

The cows are milked by machines run by electricity. These save labor, are sanitary, and cause the cows to give more milk. In Massachusetts, with so many factories, labor is expensive and labor-saving devices are important. The milking machine is entirely enclosed so few germs get into the milk. The milk is weighed and tested As Mr Shaw knows exactly how much milk each cow is producing and how rich it is, he knows whether or not each cow is paying for its keep As soon as the milk is weighed it is carefully strained and put in cans in cold water The relatively cool climate of Massachusetts makes it easy for Mr Shaw to keep



*Courtesy of International Harvester Company*

FILLING A SILO

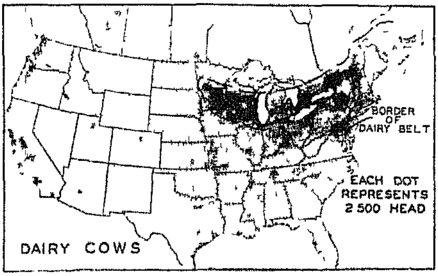
FIG 186 The corn is cut when still green and with an ensilage cutter is cut and elevated into the silo, this feed keeps up the yield of milk during winter, most dairy farmers also feed the cows cotton-seed meal cake

his milk sweet. He sells his milk to a buyer who stops for it each morning with a large truck. He also gets money from the calves and old cows he does not wish to keep.

Mr. Shaw makes more money selling milk and cream than butter and cheese The reason is that milk has a higher value when cold or fresh than when made into cheese or butter. He lives so close to Worcester, a great market, that he has no difficulty selling it It is transported rapidly and cheaply on the excellent roads from his farm to the city. Mr Shaw has no swine, while the dairyman in eastern Canada has many. Can you explain why?

## THE DAIRY BELT OF EAST CENTRAL NORTH AMERICA

**Limits of the Dairy Belt.** Study the map showing the distribution of dairy cows in the United States and Canada (Fig 187) The limits of the concentration of dairy cattle are a response to definite geographical conditions On the north the swamps and woods




THE DAIRY BELT OF EAST CENTRAL NORTH AMERICA

FIG 187 Three-fourths of the dairy cows of Canada and nearly nine-tenths of those of the United States are east of the twenty-inch annual rainfall line The dairy belt has more than half of the dairy cows of the United States and Canada Why do the following areas have few dairy cows northern Maine, the area north of Lake Superior, northern Michigan, east central New York, west central Pennsylvania?

of northern Minnesota, the rugged and sandy land of northern Wisconsin and Michigan, and the Laurentian upland of southern Canada prevent the belt from extending farther in that direction. In the east the belt extends to the ocean but areas especially favorable for fruit and vegetables are used for them instead of for dairying. The Adirondack Mountain region in New York is too rough for dairy farming and northern Maine is a forested region. On the south the dairy belt ends at about the 70 degrees Fahrenheit summer temperature line and also where the good loam soils replace the sandy soils. In this southern portion, where better soils and more favorable climate are found, corn or wheat takes the place of hay In the west low rainfall suits spring wheat better than the dairy industry. Also the dry grasses of the west are not so good for milch cows as the green luscious grasses of the east

**Conditions Favoring Dairying in the Dairy Belt.** Climate is well suited to dairying (p 189) Rainfall varying from twenty inches in the west to fifty inches in the east serves to produce luxuriantly green pastures and excellent forage crops The much lower rainfall of the west is highly efficient because most of it comes in the growing season Cool summer weather makes for higher rainfall efficiency than farther south Also dairy cattle give more milk if the weather is cool, and the milk can be more easily handled To realize the importance of this, contrast our method of milk delivery with that of Spain or Italy where goats are driven to the customer's door and milked to make sure that the milk will be fresh. Many woodland pastures with many lakes and streams also favor the dairy industry because pleasant surroundings and contentment cause the cows to give more and richer milk In some ways the long cold winters are an advantage. Where winters are long, people must have work that can be done during cold weather No field work is possible, but cows can be cared for and milked daily. Also the cold winters furnish natural ice which is cut and stored for summer use.

In three ways the topography of the dairy belt promotes the dairy industry The land may not be level enough for many crops; the slopes may be so steep that erosion will result if planted

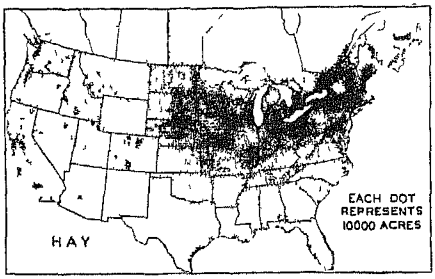



FIG 188 Most of the hay of the United States and Canada is grown in the dairy belt and in the corn belt What four crops are used for hay (forage) on the Darkenwald spring-wheat farm? What two on the Heath hard-winter wheat farm? What four reasons cause Mr Jones to grow so much hay on his corn-belt farm? Mr Shaw on his dairy farm? In the dairy belt (page 219) hay makes up one-half the acreage of all crops, in New England from 75 to 85 per cent of all crop land is in hay

in crops other than hay or tree crops; rough land may so isolate a farm that it is necessary to produce a high value commodity for sale in which case cheese or butter is satisfactory Many of the regions that are not rough are unsuited to other crops because of soil. In Minnesota, Wisconsin, Michigan, and sections of New England, there is much land too sandy for crops and better devoted to hay and pasture (Fig 188) In the northern part of the glaciated area much poorly drained land has soils unsuitable for crops. In addition most of these soils have been developed under forest vegetation and are infertile. On the excellent soil areas in the region crops are produced. Potatoes, other root crops, rye, hay, and oats are best adapted to the soils and climate of the region (Fig 189).

Compare the map of dairy cattle with the population map of the United States and Canada. Notice the dense population of the dairy region. About thirty-six million people live within its boundaries, a much greater population than in any other agricultural region of North America, in the region and near it live more than one-half of the urban population of the United States and Canada What is still more significant is the fact that of the people of the region only one-fifth are on farms, the four-fifths in cities, requiring fresh milk daily, furnish a huge market

As the dairy farms lie near large cities, many of them have the finest means of transportation available This is important because fresh milk, the principal product, is bulky, hard to handle, and must be consumed quickly. The milk trains make metropolitan railroad yards busy places, while huge motor trucks with glass-lined tanks transport enormous quantities of milk from farms fairly near the city. Great cities like New York and Chicago require so much milk that they draw upon farms several hundred miles distant, New York importing much milk from Canada However, most of the milk goes less than one hundred miles to market,

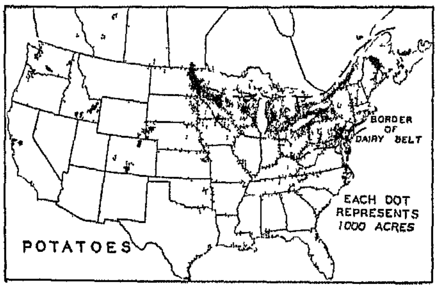



FIG 189 More than half the potato crop in North America is produced in the dairy belt This is owing to the large yield of potatoes in a cool summer, large areas of sandy soil well suited to a tuber crop, competition in other regions of corn which requires much labor at the same time as potatoes, and the huge market in this region.

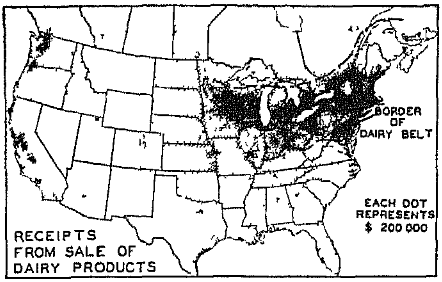



FIG 190 The concentration of receipts from sale of dairy products in the dairy belt is greater even than the concentration of cows What is the chief dairy product sold from northern Vermont, western New York, eastern Michigan, southern Wisconsin, central Wisconsin, Minnesota, and northeastern Iowa?

hence the eastern part of the dairy region sells more milk because of the greater number of cities, while the western specializes in butter and cheese.

Minnesota is the great butter state, manufacturing almost one-fifth of the country's creamery butter. Butter is an important food and can be shipped farther than milk to eastern markets. Wisconsin is a great cheese state producing two-thirds of the nation's output It also ranks third, or next to Iowa in butter. Combining its enormous cheese production, large butter production, and fairly large fluid-milk production for city use, Wisconsin far outranks any other state in total value of dairy products (Fig 190) The southeastern counties of Wisconsin supply the cities with milk, hence there are few cheese or butter factories here Farther northwest the production of butter and cheese is more important, resulting in a sprinkling of cheese and butter factories. Butter factories are usually in the better districts where silage corn and plenty of hay may be grown for winter feed, thus making a larger output of milk throughout the year. Those sections which make cheese mainly are found where forage is less abundant Here the farmer does not do much milking in the winter, he merely feeds the cows enough to keep them in good physical condition. In the spring, summer, and fall he does the greater part of his milking while the cows are pastured on luscious grasses.

Southeastern Canada, included in the dairy region (p. 219), has about two-thirds of the Canadian population and ranks as the great dairy region of that country. Milk, butter, and cheese are all important. Dairying is supplemented by the production of bacon hogs fed on the skim milk, barley, and root crops. Canada has three important markets for her products, her own people, eastern United States, and England

## EXERCISES

1. In what ways is dairying the most advanced type of farming?

2. (*a*) In table form contrast in size, fields, fences, buildings, crops, and animals the Darkenwald spring-wheat farm and the Shaw dairy farm in Massachusetts (*b*) Make a list of the machinery used on each of these farms

3 (*a*) Answer the questions under Fig. 185. (*b*) What five reasons cause Mr. Shaw to raise so much hay? (*c*) Why does Mr Shaw give so much time and care to his cows? (d) How does he market his milk?

4. (*a*) What is the dairy belt? (*b*) What limits it in each direction? (*c*) Why doesn't it extend into the southern states? (*d*) Into the Great Plains? (*e*) Answer the questions under Fig. 187.

5 (*a*) List the several conditions that favor dairying in the dairy belt (*b*) List the conditions to explain why Minnesota is the great butter state and why Wisconsin is the great cheese state.

6 Contrast in animals, crops, dairy products, and markets the dairy industry of Massachusetts with that of southern Canada

## AN EXTRA LESSON

Visit a nearby large dairy farm, or a large creamery, or condensary. Before going, work out the chief aim of your visit, list the things you plan to observe, and the questions you plan to ask. Keep notes as you study the plant Write a paper on "A Dairy Farm," "A Creamery," or "A Condensary," bringing out, wherever you can, the relation of geographic conditions.

## READINGS[1]

"Milk, Butter and Cheese" — 9, Chapter XIII, 1, pp. 233–238, 13, pp 146–186; 24, pp 240–247, 94, pp 129–131; 106 (1922), pp 281–295

"The Milk Supply" — 1, pp 233–238, 20, I, pp. 54–74; 24, pp 247–259

"The Dairy Region" — 87, pp. 330–337; 95, pp. 135–142, 23, pp 168–175.

"The Hay and Dairy Belt" — A, IV (1928), 44–73, quite detailed, several maps, 12, pp. 367–369

"The Dairy Industry" — 106 (1922), pp 281–394, long and detailed.

"Importance of Dairy Products as Food" — 24, pp 240–246; 13, pp. 146 ff.; 95, pp. 135–137

"The Development of the Dairy Industry in the United States" — 106 (1922), pp 297–319, many maps.

"Why Dairying has become so Important in this Country" — 106 (1922), pp 281–284.

"Physical Conditions for Dairying" — A, IV (1928), 44–52, and other references and texts

"Crops in the Dairy Belt" — A, IV (1928), 53–58 and several maps in the text

"The Variation of Agriculture in the Dairy Belt" — A, IV (1928), 59–67, 87, pp 49–52, 103–116, 390–392.

"Breeds of Dairy Cows" — 9, Chapter XIII; 106 (1922), pp. 319–331.

"Cheese Industry of Wisconsin" — A, II (1926), 292–308.

"Marketing Dairy Products" — 106 (1922), pp. 351–366.

"The Influence of the Cream Separator and Milking Machines" — 9, Chapter XIII; 20, I, 54–74, 13, pp 147–163.

"A Visit to a Creamery" — 20, I, pp. 64–74, 13, pp 159–163.

"Pasteurizing Milk" — 98, No. 240,

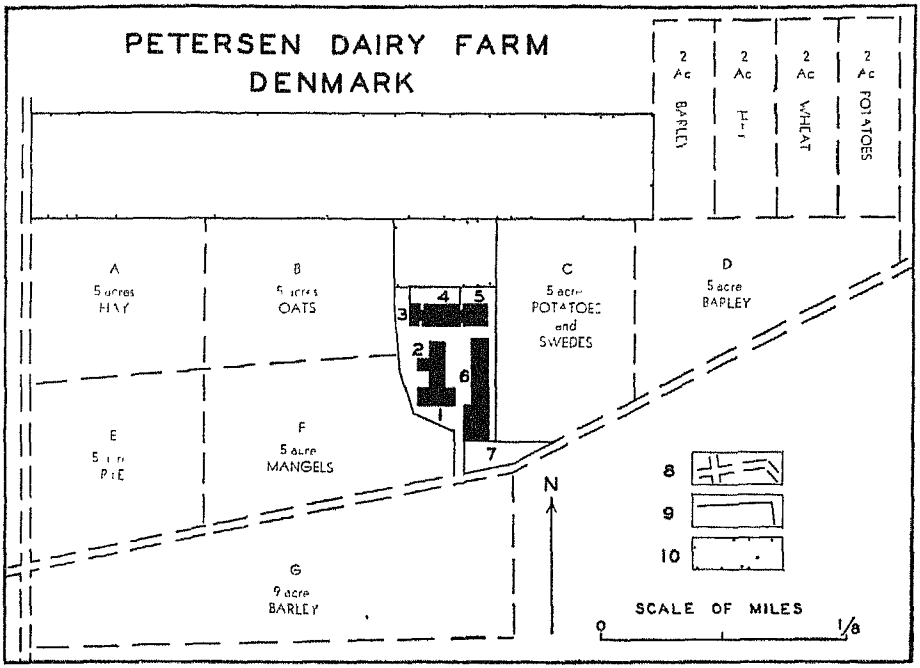
"Scottish Agriculture" — A, X (1934), 217 ff.

## § II — DAIRY FARMING IN OTHER LANDS

### DAIRYING IN EUROPE

The world's most advanced dairying districts lie in northwestern Europe All the world's important breeds of dairy cattle originated in these lands — the Jersey, Guernsey, and Ayrshire from the British Isles, the Holstein-Friesian from Holland, the Brown Swiss from Switzerland, and other breeds. Some of the intensive dairy sections like northern Italy, northern France, the Netherlands, and Denmark have two and three times as many cows per square mile as the

[1] Numbers and letters refer to Selected References on pages 420–424.




*Drawn from information supplied by Harald Branth*

Petersen Dairy Farm, Denmark

Fig 191 1, House 2, Workers living quarters 3, Garage, wood shed, and tool shed 4, Chicken house 5, Hog house 6, Horse stable, dairy barn, and hay barn 7, Cattle yard 8, Roads 9, Fenced field borders 10, Permanent pasture The barn is large and has high roofs for hay storage, one section of the floor is open for the threshing machine, one bin is well ventilated for turning the grain in this damp climate The roots are kept in pits covered with straw and dirt

The farm contains 61 acres In one year the crops were distributed as on the map grains occupied 44 per cent of the farm land, permanent pasture, hay, and green forage occupied 35 per cent, and roots used about 20 per cent This distribution of crops corresponds closely to the use of farm land in all Denmark in a recent year grains, 42 per cent, pasture and green fodder, 35 8 per cent, roots, 18 4 per cent, other crops and fallow, 3 8 per cent

Mr Petersen has two teams of Belgian horses, sixteen cows of the red Danish breed, he sells the cream to a near-by creamery He keeps eight sows and plans to sell to the bacon factory each year about seventy pigs weighing one-hundred eighty pounds each; he keeps one hundred forty laying hens, and raises about two hundred chickens for sale, he keeps about thirty ducks and ten geese, he veals the steer calves

densest dairy regions in the United States.

**Denmark, the "Coöperative Country."** The Petersen dairy farm (Fig. 191) illustrates well the type of dairying carried on in Denmark. The farm, containing sixty-one acres of land, is larger than the average. One-fourth of the farms of Denmark comprise less than one and one-half acres, 50 per cent comprise less than thirteen and one-half acres, and 70 per cent comprise less than forty acres. The small size of the farms is a recent condition, for not many years ago most of the land was in large estates With the change from wheat farming to dairying the estates were broken up. Now

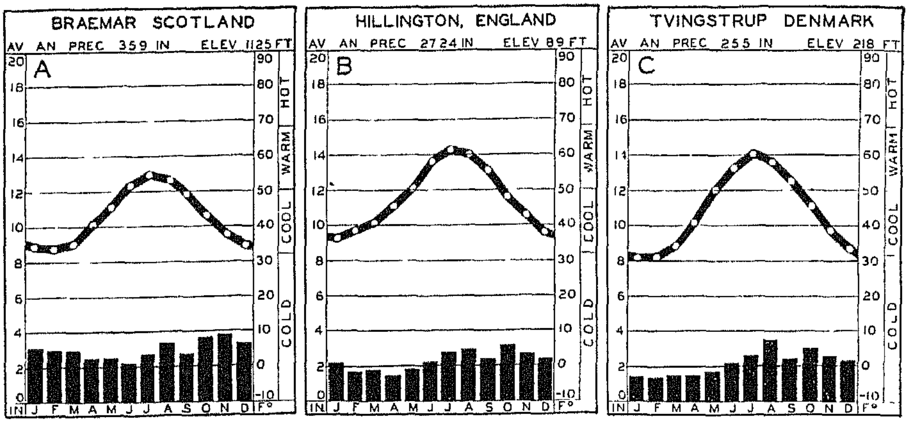
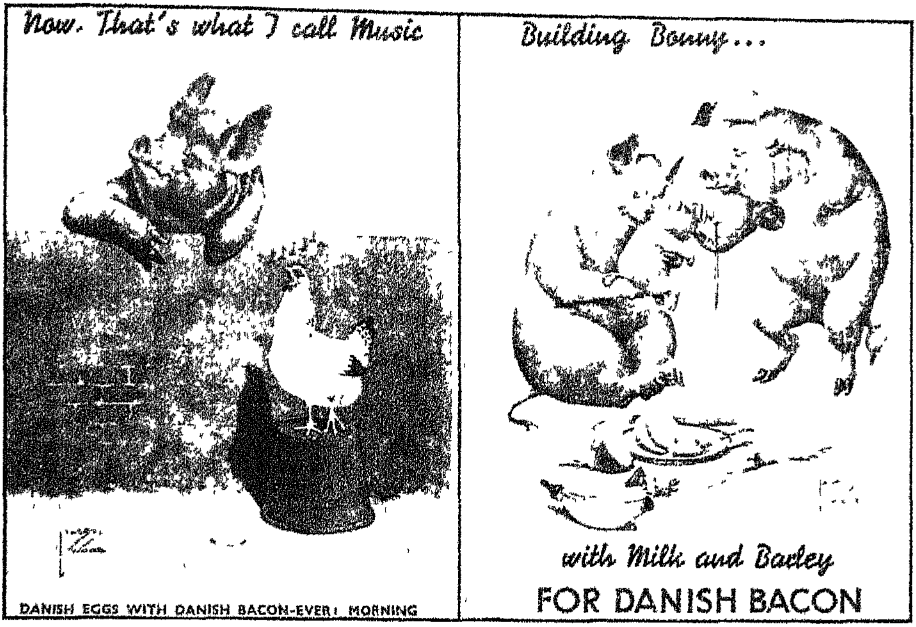



FIG 192 Chart A shows rainfall and temperature conditions in the highlands of Scotland near Whitehillock's farm, Chart B those in the plains of England near Westwood farm, Chart C those in Denmark near the Petersen dairy farm Compare Chart C with Chart C, page 189 The cool, rainy climate is especially adapted to the production of root crops, barley and oats, and good hay and pasture

many farms are so small that a farmer and his family can operate one without much hired help

Mr Petersen practices a very intensive type of farming. How many acres of his farm are not used for crops or pasture? His level farm has sandy loam soil, there is sufficient rain for crops and the winters are mild He practices rotation of crops. On the seven large fields the order of crops is: (1) hay, (2) oats, (3) potatoes and swedes, (4) barley, (5) rye, (6) mangels, and (7) barley; on the four small fields: (1) barley, (2) grass, (3) wheat, and (4) potatoes. He fertilizes the land heavily with manure and sometimes with commercial fertilizer. Wheat and rye, sown in the fall, are chiefly for food, other grains, hay, and roots are for feed for cows, pigs, and chickens. Roots, with much labor, give high yields per acre and are excellent feed for cows and pigs. The sandy soil and cool moist climate favor root, barley, and hay culture (Fig 192). Even with all this feed, Mr. Petersen has to import for his cattle cotton meal from the United States and corn from Argentina The cows are stall fed most of the year When they are fed on hay ground, they are tethered — most of Mr Petersen's fields are not fenced

The government and the people have done much to help the dairy farmer. The government loans money on easy terms to persons who want to buy dairy farms or good cows. It establishes dairy schools, sends men to teach farmers how to raise products of high quality, and provides inspectors who check the results. The farmers keep careful records of cost of feed for cows and milk yields. Poor animals are eliminated from the herd. In Denmark nearly every farmer belongs to a coöperative association. There are coöperative creameries, cooperatives for slaughtering bacon hogs, for selling and inspecting eggs, for buying stock feed, machinery, household supplies, or fertilizers. The result has been to set an example to all the world of what can be done by people who coöperate. Today on the great Lon-




*Courtesy of Danish Bacon Company*

ADVERTISING DANISH BACON AND EGGS

FIG 193 Bacon and eggs are two important Danish exports Milk, barley and roots make excellent feed for bacon hogs Where would these advertisements be used?

don market a merchant has only to tell the buyer that the eggs, butter, or bacon is stamped by a Denmark cooperative and the customer knows it will be good (Fig. 193). If a customer gets a bad egg, he may return it to the grocer who will return his money, send the egg number to the cooperative which in turn goes to the farmer who sold the egg. The farmer is fined for having been so careless as to let a poor egg get onto the market.

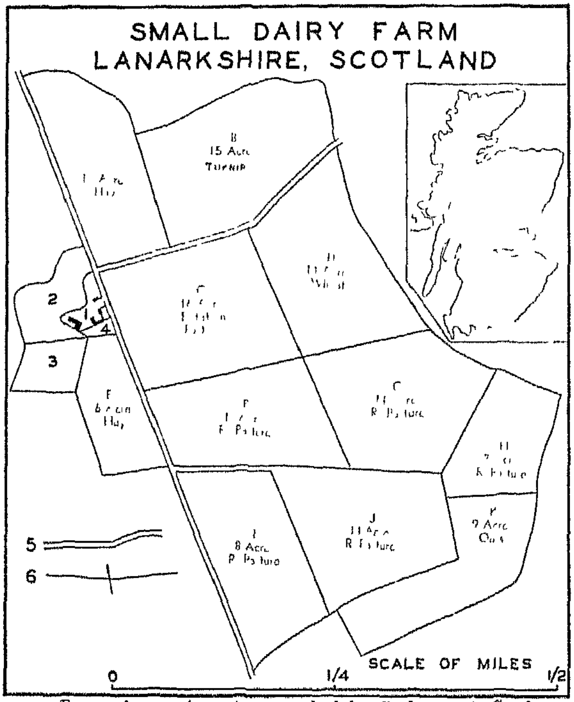
This great, successful development was not completed without many struggles. Many times agricultural leaders had difficulty in convincing the people of the value of coöperative projects. Today there are agricultural schools throughout the country to teach the people how to farm scientifically and to strengthen the idea that farming is an honorable profession.

**Dairy Farming in Scotland.** Perhaps people think too much of Scotland in terms of the Scotch highland areas Although more than half of the country is highland, nine-tenths of the people of Scotland live in the lowlands In the lowland eight miles southeast of Glasgow lies the Lenarkshire dairy farm of 133 acres (Fig 194). In the summer the great stone buildings look beautiful against a background of green hedges and hay fields. The house is neat and well built. Only fireplaces are used for warming the building, for in spite of the high latitude the climate is mild during the entire year. The barn is a large stone structure to which are attached sheds, feed houses, and a milk

house Everything on the farm centers around the production of milk, for Glasgow furnishes an excellent market The farmer keeps a herd of thirty Ayrshire cows in milk and about sixty laying hens, he plans to raise two hundred chickens for sale each year

With the exception of wheat, all the crops are those we usually associate with mild, moist climates. Rotation pasture occupies more than half of the land, while hay ranks next, followed by turnips, wheat, and oats A small piece of stony rough land is used for calf and chicken pasture, while a three-acre plot furnishes some vegetables for the Glasgow market

A nine-year rotation system consists of oats, turnips, wheat, hay, and five years of rotation pasture The moist cool climate results in excellent pastures and hay crops while the light soil is also better suited to hay, oats, and turnips than to most other crops This farm is more fortunate than most



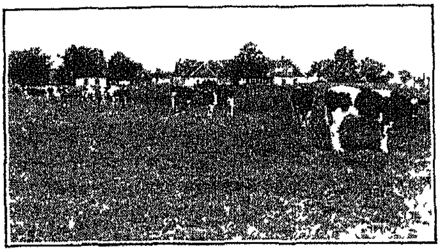

*Drawn from information supplied by Catherine P. Snodgrass*

DAIRY FARM, LANARKSHIRE, SCOTLAND

FIG. 194 1 Farm buildings dairy and horse barn, house, sheds and chicken house; 2 calf and chicken pasture, 3 market garden crops; 4 home garden, 5 roads, 6 stone and hedge fences. The black triangle on the inset map of Scotland shows the location of the farm.

This dairy farm specializes in certified milk for the Glasgow market The farmer uses four work horses, and employs two hired men and their wives, and two girls who help with the milk and chickens. In one year the fields were used as shown on the map How many acres were in rotation pasture? In hay? In oats? Adding these gives the acreage devoted to forage crops for the dairy cows What percentage of the farm is used for feed for the cows? After a field has been in rotation pasture for five years, it is plowed and planted with oats, this is necessary to renew the pasture and keep the land fertile.

of those in Scotland for since it has no exceedingly rough land all fields, except 2 and 3, may be used in the crop rotation system Farther west in this Midland Valley of Scotland more land is in grass while farther east the amount of grassland becomes less. This is due to the fact that the climate is much more moist in the west than in the east.



*Courtesy of Swedish State Railways*

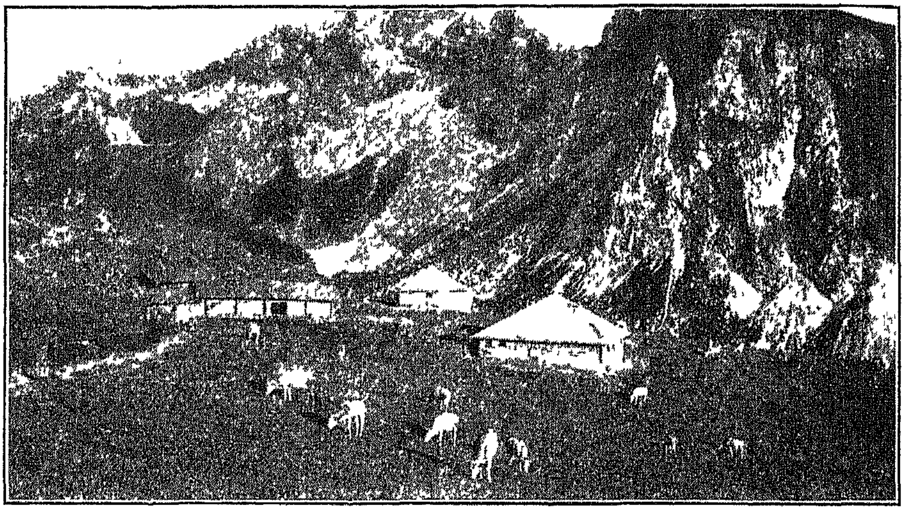
A SWEDISH DAIRY FARM

FIG 195 As in Denmark, Holland, and other regions of Europe the cows are often tethered in the fields Here roots, cereals, and hay provide much of the feed of the cows

**Other Dairy Countries of Europe.** The general conditions of mild moist climate, loose sandy soil, dense population, and in places rough mountain lands favor dairying in much of northwest Europe. Southern Sweden is a great dairy country (Fig. 195). The Netherlands produce much butter and cheese; cheese especially is an important export. Finland exports both butter and cheese. Northern France has excellent butter, while the highlands of southern France have a great reputation for cheese. The famous Roquefort cheese from this section is made from sheep milk and is cured in limestone caves. Dairying in Germany and Italy is important, though most of the products are consumed at home.

In the cool mountainous land of Switzerland the dairy industry is highly developed, the word "alps" means mountain pasture land Above the tree line in the mountains are many areas of wild grass which the animals cannot reach But the agile Swiss can, and some give much of their time in summer to gathering wild hay So important is this source of hay considered that by law no family may have more than one gatherer of wild hay

The mountain pastures are so rich that Swiss dairy products are among the world's best The high pastures include *one-fourth of the productive* area of Switzerland and the hay meadows one-fourth Fields and gardens occupy only one-fifth. To utilize the high pastures between the forests and the mountain snows, the Swiss have developed an interesting kind of semi-nomadism. Their permanent homes lie in the valleys where they have small farms to raise food and feed for the long winter when the pastures are closed by snow. In the spring as the snow line begins to recede, some member of the family leaves with the cattle for the high pastures. He plans to spend the entire summer there, climbing higher and higher as the snow disappears and descending with the herd for the second growth of grass At certain levels are buildings, to which he returns with the animals for milking and shelter (Fig. 196) There he prepares the butter and cheese and from time to time his people come up to get what he has prepared. In many parts of Switzerland the word "cheese" is used as a synonym for food as we sometimes use "bread" The boy who makes good cheese is popular with the girls. In the winter the animals remain in the



*Courtesy of Swiss Federal Railways*

FIG 196 A BEAUTIFUL ALPINE PASTURE IN THE BERNESE OBERLAND, SWITZERLAND

valleys where they are fed the hay and roots produced on the lowlands while they grazed in the "alps."

## DAIRYING IN SOUTH TEMPERATE LANDS

**New Zealand Dairy Industry.** The combined cheese and butter trade of New Zealand gives her world supremacy in the export of these commodities. She holds this record in spite of the fact that she is on the opposite side of the world from England, her great market. It seems almost impossible that the New Zealand farmer can ship his butter and cheese twelve thousand miles and still sell it as cheaply as do farmers from regions within a few hundred miles. Geographic and economic conditions in New Zealand must indeed be favorable

The New Zealand dairy industry began in 1840; yet by 1880 the exports of butter and cheese were rather small. Although it required a multitude of factors to make the dairy industry of New Zealand a success, yet the use of the refrigerator ship, which made its first voyage in 1882, was the great factor that gave the New Zealanders assurance that they could get butter and cheese to Europe in as good condition as when it left New Zealand. Previous to this butter and cheese traveling across the Equator and such a great distance arrived in England in very bad condition The cheese tasted bad and after the voyage butter was almost worthless.

The moist mild climate of New Zealand favors excellent grass and hay crops, while open winters allow year-round pasturing and good conditions for handling the milk (p. 80). The favorable soils make it possible for the farmer to have large fields of fine pasture. Besides all these natural aids, the New Zealanders have cooperated in order to market their products to best advantage. The New Zealand dairy products, like those of Denmark, have an enviable reputation on the world market. No cheese or butter may leave New Zealand without passing the rigid test of coöperative and government inspectors.

**Dairying in Australia, Argentina, and South Africa.** To these remote regions refrigeration was also exceedingly important The effect of frequent drought in Australia makes the amount of butter export fluctuate greatly Dairying in Argentina is developing and has great possibilities, but at present her great profit is in beef cattle Dairying is likely to develop slowly, because of the fact that it has strong competition, demands tedious work, and requires greater skill than the raising of beef cattle South Africa is a pioneer region with possibilities, but at present competition from more favored regions limits its export possibilities

## EXERCISES

1 As you study the chapter, in table form contrast the Denmark dairy farm with the Scotland dairy farm in size, fields, fences, buildings, crops, and animals

2 (*a*) What products does Mr Petersen depend on for his cash income? (*b*) The Scotch dairy farmer? (*c*) Mr Shaw in Massachusetts?

3. Taking the crops on Mr Petersen's farm as for this year, work out the crops on each field for next year, using the order of rotation given in the text

4 (*a*) What conditions caused Mr Petersen to change his type of agriculture years ago and develop dairying with strong cooperative organization? (*b*) What advantage does such an organization give to a group of producers? (*c*) To people buying from them?

5 (*a*) List all the conditions you can that favor the intensive dairying of Denmark (*b*) The dairy industry of western Scotland

6. (*a*) In what other countries of Europe is dairying highly developed? (*b*) What conditions favor dairying in Switzerland? (*c*) Contrast the method of taking care of the cattle in Switzerland with that in Denmark

7 (*a*) List several conditions to explain why New Zealand leads all countries in the export of dairy products (*b*) From the rainfall maps, cattle maps, and population maps determine what sections of Australia and Argentina have developed the dairy industry

## AN EXTRA LESSON

"World trade in dairy products" Study the table p. 230, and the text for information on the subject Take a small outline map of the world, with ink place the exports of cheese in millions of pounds for each country on that country, draw a green circle around the number, draw a line showing the route of the exports to the chief importing region In the same manner, using a red pencil, indicate the trade in butter.

List the factors which make it possible for the Netherlands, New Zealand, and Canada to ship 64.5 per cent of the world's exports of cheese, for New Zealand, Australia, and Denmark to supply 57 5 per cent of the world's exports of butter Why do the United Kingdom and Germany buy 85 1 per cent of the world's imports of butter, and 63 3 per cent of the world's imports of cheese?

CHEESE TRADE OF THE WORLD
(Thousands of pounds)
(Recent 3-year average)

| *Principal Importing Countries* | | *Principal Exporting Countries* | |
|---|---|---|---|
| United Kingdom | 334 840 | Netherlands | 202 378 |
| Germany | 134 420 | Italy | 80 432 |
| France | 66 220 | Switzerland | 63 250 |
| Belgium | 49 060 | Denmark | 12 144 |
| Italy | 12 100 | Czechoslovakia | 8 536 |
| Spain | 5 500 | United Kingdom | 5 918 |
| Austria | 5,280 | Germany | 5,874 |
| Switzerland | 5,280 | France | 5,324 |
| Other European Countries | 7 194 | Other European Countries | 21 377 |
| United States | 68 640 | New Zealand | 194,766 |
| Algeria | 8 580 | Canada | 85,778 |
| Egypt | 7 128 | Australia | 6 578 |
| Argentina | 4 026 | United States | 3,916 |
| Cuba | 3 740 | Union of South Africa | 1,276 |
| Dutch East Indies | 2,200 | | |
| World total | 755,737 | World total | 748,462 |

BUTTER TRADE OF THE WORLD
(Thousands of pounds)
(Recent 3 year average)

| *Principal Importing Countries* | | *Principal Exporting Countries* | |
|---|---|---|---|
| United Kingdom | 792,000 | Denmark | 366 300 |
| Germany | 270,380 | Netherlands | 89,540 |
| Belgium | 24 420 | Irish Free State | 54 560 |
| France | 21 120 | Russia | 48 840 |
| Switzerland | 19 360 | Latvia | 38 060 |
| Netherlands | 5,720 | Finland | 37 420 |
| Other European Countries | 6 816 | Estonia | 29 920 |
| Canada | 25,740 | France | 13,200 |
| Dutch East Indies | 13,420 | Other European Countries | 2 924 |
| Algeria | 3,740 | New Zealand | 205 700 |
| Trinidad and Tobago | 2,640 | Australia | 139 700 |
| United States | 2,200 | Argentina | 46 420 |
| Cuba | 1,980 | United States | 6 974 |
| Egypt | 1,980 | Canada | 4 180 |
| China | 1,320 | Union of South Africa | 2 992 |
| World total | 1,248,024 | World total | 1 237 664 |

## READINGS [2]

"Dairying in Other Lands" — 9, Chapter XIV; 2, IV, Chapter XIII; 24, pp 259–265, 23, pp. 175–183

"Denmark" — 65, pp 1–18, 94, pp. 428–430, 86, pp. 386–389; 61, pp. 328–332, 12, pp. 573–577

"Switzerland" — 65, pp 154–159, 86, pp. 384–385; 61, pp. 276–278, 23, pp. 178–179.

"Australia" — 26, pp 140–143, 189–191; 24, pp 264–265, 23, pp 181–182.

"The Dairy Industry of New Zealand" —26, pp 419–422, 427–431; A, III (1927), 281–296

"Argentina" — 17, pp 380–382; 75, pp. 56–57, 24, p 265; A, IV (1928), 27–29; 23, pp 182–183.

## TOPICS FOR INVESTIGATION AND REPORT

Make a special study of the relation of crops to the animals on a Denmark dairy farm — use references above and the text

"Different Types of Cheese" — 13, pp. 164–186; 65, pp. 281–284; A, II (1926), 292–308

"How New Zealand has Developed its Great Dairy Industry," — A, III (1927), 281–285, 289–296

"Dairy Substitutes" — 23, pp 183–188.

"Dairying in Argentina" — 75, pp 56–57; 17, pp. 380–382.

[2] Numbers and letters refer to Selected References on pages 420–424.

# PART V

# THE FOREST INDUSTRIES

*Courtesy of Dr Avelino*

GATHERING BRAZIL NUTS

FIG 197 These men go through the forest, pick up the large capsules which weigh from three to four pounds and contain fifteen to thirty nuts, and carry them to river boats, the capsules are nearly as large as the boy's head Note the large trees and the thick undergrowth

# CHAPTER XIX

# FORESTS AND THEIR USE

**Three Major Types of Forests.** While the world contains many species of forest plants, we may distinguish three major types of forests These are tropical hardwood forests, temperate hardwood forests, and temperate coniferous softwood forests (Fig 197) As suggested by their names, these three types differ largely as a result of climate. They constitute one of man's greatest as well as one of his most sadly misused resources But there are great differences in the use made of forests

**Tropical Hardwood Forests.** Man has made much less use of the tropical hardwood forests than of the temperate forests, although they occupy nearly one-half of the area in forests today (Fig 198).[1] The reasons for

[1] TYPES OF FORESTS BY CONTINENTS

| Continents | Conifers: Millions of Acres | Conifers: Percentage of World Total | Temperate Hardwoods: Millions of Acres | Temperate Hardwoods: Percentage of World Total | Tropical Hardwoods: Millions of Acres | Tropical Hardwoods: Percentage of World Total |
|---|---|---|---|---|---|---|
| Europe | 579 | 21.9 | 195 | 16.2 | | 0.0 |
| Asia | 889 | 33.6 | 572 | 47.5 | 635 | 17.5 |
| Africa | 7 | 0.3 | 17 | 1.4 | 773 | 21.2 |
| Australia and Oceania | 15 | 0.6 | 15 | 1.2 | 253 | 7.0 |
| North America | 1,046 | 39.5 | 290 | 24.1 | 108 | 3.0 |
| South America | 109 | 4.1 | 115 | 9.6 | 1,869 | 51.3 |
| Total | 2,645 | 100.0 | 1,204 | 100.0 | 3,638 | 100.0 |

Zon and Sparhawk Forest Resources of the World, Vol. I, p 14

Compare the shape of North America and Eurasia on this map with that on a globe. Explain why the temperate forests on this map appear to occupy a much larger area than that covered by the tropical forests Add the total figure for conifers and that for temperate hardwoods, how does the result compare with the acres of tropical hardwoods?

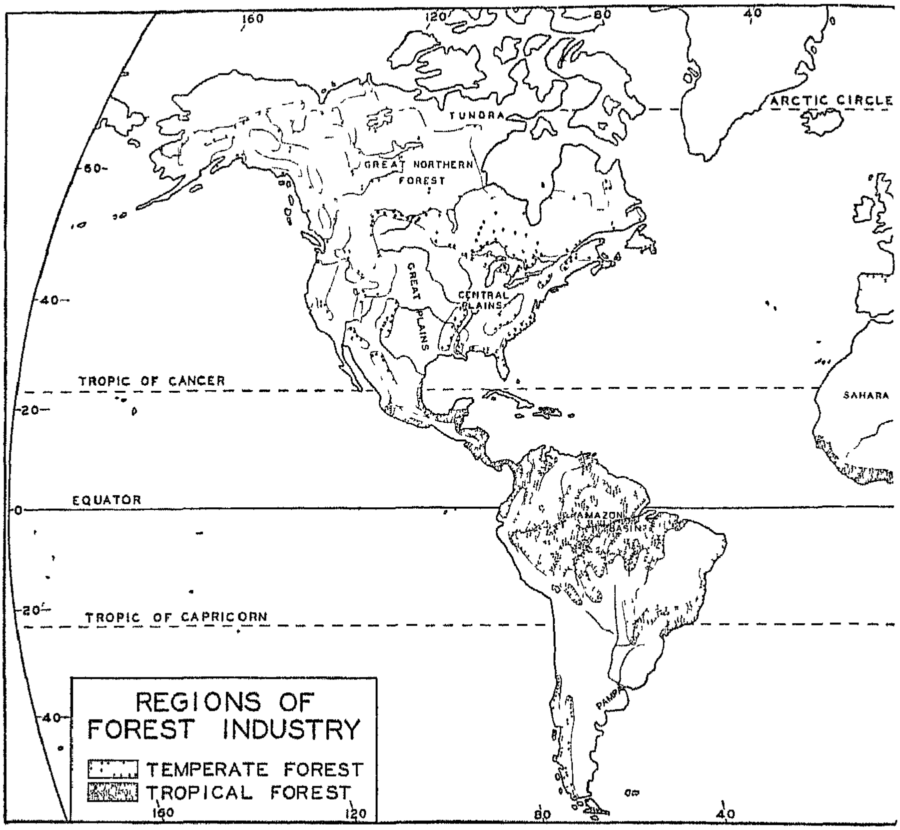
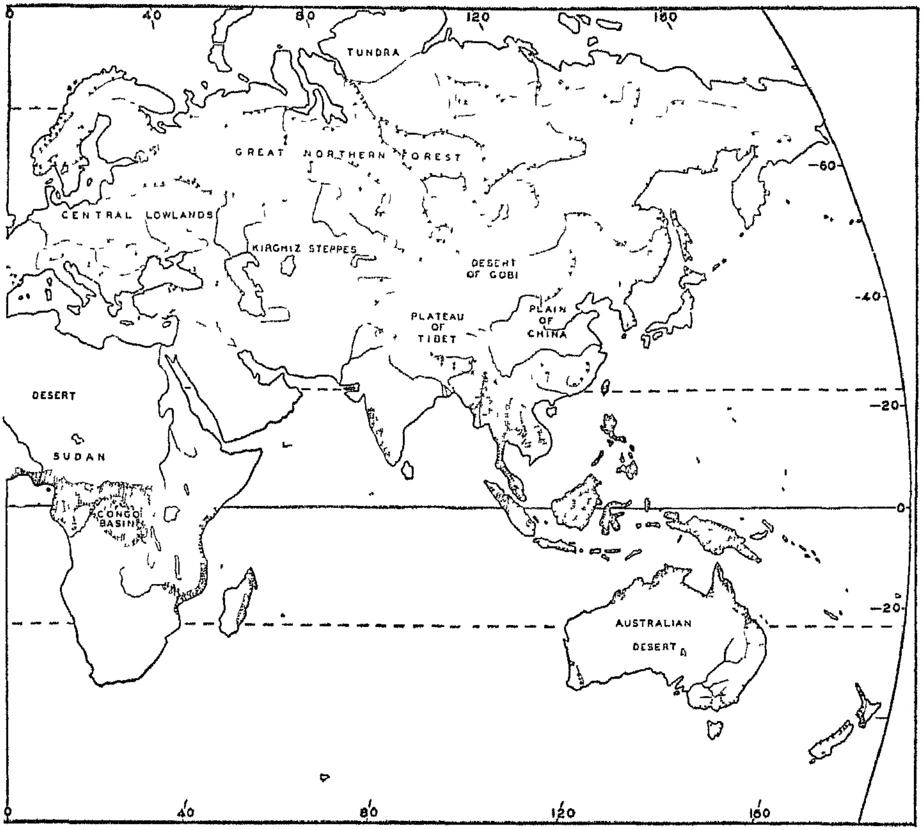



FIG 198 Contrast the map of regions of forest industry with the map of chief on plains, five or more where they grow on mountain areas What is the density of regions have the forests largely been cleared? Why are the areas of temperate forests

this failure to develop these resources appears in the conditions under which the tropical hardwoods grow: high temperatures throughout the year, heavy rainfall at all seasons, much sunshine, deep soil, and good drainage. Also the climate is unhealthful, the regions are remote from centers of population, the wood is hard to cut and work, and the trees grow in scattered fashion The most extensive area of these forests is in the Amazon basin. Other important areas are in similar lands in the Caribbean region, central Africa, southeastern Asia, and eastern Australia These forests produce many valuable products, such as expensive woods like mahogany, ebony, teak, and rosewood, and a variety of nuts, drugs, oils, gums, and fibers (Fig 199). In some districts other products are far more important than lumber (p. 238).

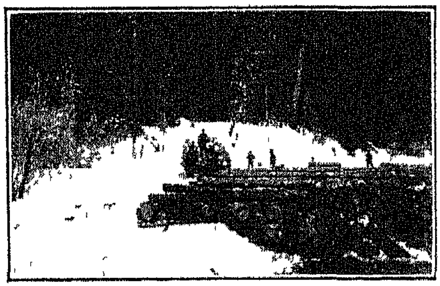
**Temperate Hardwood Forests.** Hardwood forests of the temperate zone have been most cleared. Not only has man made greatest use of the trees, but since they occupied lands very suitable for cultivation the trees were removed to make place for farms. Forest remnants occupy only tiny portions of the former area. Instead of




*After Bartholomew, Goode and Zon*

grazing regions Point out on the map five or more areas where extensive forests grow population in each of the great forest areas? On what three large plains or lowland so much smaller in the southern hemisphere than in the northern hemisphere?

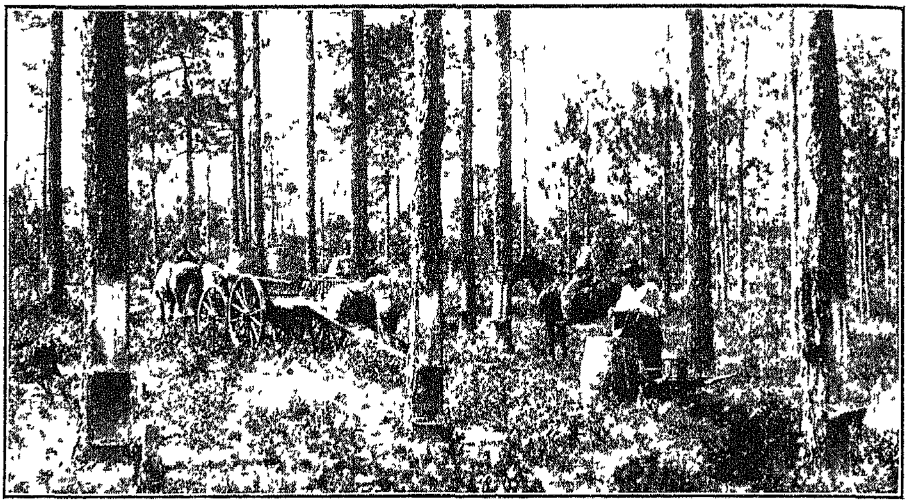
forests the land has some of the world's densest populations and contains the world's main manufacturing regions and leading countries. The factors favoring temperate hardwoods, which are deciduous trees, also favor man. With a mixture in some places of coniferous softwoods, they grow where the winters are cold but not too long and where the summers are warm and where all seasons have ample rain (pp 14–15). Before man made inroads the eastern United States, western Europe, and eastern China were covered with temperate hardwoods. Important trees in this class are oak,



*Courtesy of United States Forest Service*

WINTER LOGGING SCENE

FIG. 199 In the northern coniferous forest the logs, cut and hauled on sleds in winter time, are piled high on the ice at the river's edge to be carried downstream to the sawmill or paper mill with the first big spring thaw.



*Courtesy of United States Forest Service*

IN A SOUTHERN PINE FOREST

FIG 200 Collecting gum and loading barrels for hauling to the turpentine still

birch, beech, maple, ash, walnut, and sycamore These woods, because of hardness and attractiveness, are suitable for many uses Forest products, other than wood, are not so important as in tropical hardwood forests. Not only does the climate attract man and thus favor cutting, but the habit of the trees in growing in stands containing only a few varieties makes these forests easily utilized.

**Temperate Coniferous Softwood Forests.** These forests now have the world's main forest industries. One-half of the world's wood today comes from them and they are the major source of pulpwood for the manufacture of paper Consequently, cutting proceeds rapidly, but huge areas still remain little used These forests, consisting of vast stands of spruce, fir, pine, hemlock, and the like, thrive in short warm rainy summers and long cold winters. Man has not occupied much of this land as it is not well suited for agriculture. Why (pp. 12–13 and 14–15)? The largest part of this type of forest forms a huge belt of evergreens across Canada and northern Eurasia. Besides the ease with which the wood is worked and the value of the pulpwood, these forests attract development because the snows of winter make it easy to transport logs and in spring the numerous rivers facilitate transportation to mill or market. Moreover, these forests yield most of the world's furs (p. 20) and the southern portions furnish the world's supplies of naval stores (Fig 200). These forests lie near areas of dense population.

## EXERCISES

1. (*a*) What are the three major types of forests? (*b*) Using the maps pp. 4–5, 10–11, 12–13, 14–15, 62, 63, compare and contrast the three types as to relief, annual precipitation, seasonal distribution of precipitation, length of growing season, and population. Write the results in table form as follows:

| | *Tropical* | *Temperate Hardwoods* | *Temperate Softwoods* |
|---|---|---|---|
| 1 Relief | | | |
| 2. Annual precipitation | | | |
| 3 Seasonal distribution of precipitation | | | |
| 4 Temperatures | | | |
| 5 Population density | | | |

2 Study the pictures on the following pages and write out in three columns the chief characteristics of the different forests illustrated, pp 238, 260, 272 and 276

| *Characteristics* | *Tropical* | *Temperate Hardwoods* | *Temperate Softwoods* |
|---|---|---|---|

3 Study the climatic charts, Figs 101A, and 157C (*a*) What are the chief differences between them? (*b*) How are these differences related to the forests?

4. Why are the following areas not forested the northern margin of North America, the Great Plains, northern Africa, western Asia, central Australia, the plateau of Tibet, and central India?

5 Explain the absence of forest industries in the south temperate zone as compared with the north temperate zone

6 In the north temperate zones, particularly the eastern half of the United States and northwestern and central Europe, the land originally covered with forests has become densely inhabited by man, in the tropics, the original forests still remain a region of sparse population Explain (text, p 234 and maps)

7. (*a*) Why are the tropical forests least cleared? (*b*) Why are the original temperate hardwood forests most cleared?

8 Make a list in three columns of the valuable trees of the tropical hardwood, temperate hardwood, and temperate softwood forests.

## READINGS [2]

"The Great Forests" — 23, pp 451–497, selected portions; 16, pp 302–307

"Man and the Tropical Forest" — 85, pp 19–30; 16, pp. 315–321.

"Tropical Lumber for Industrial Arts and Vocational Work" — 57.

"The Forestry Primer" — 49.

"Forests and Their Many Uses" — 2, I, pp. 263–290

"The Great Northern Forest" — 87, pp 394–408.

"Life in the Temperate Forests" — 74, pp 15–21.

## TOPICS FOR INVESTIGATION AND REPORT

"A Trip Through Canada's Hinterland" — **H**, II (1931), 3–21, excellent pictures

"The Great African Forests and the Life in Them" — 7, V, Chapters XXXV, XXXVI, and XXXVII.

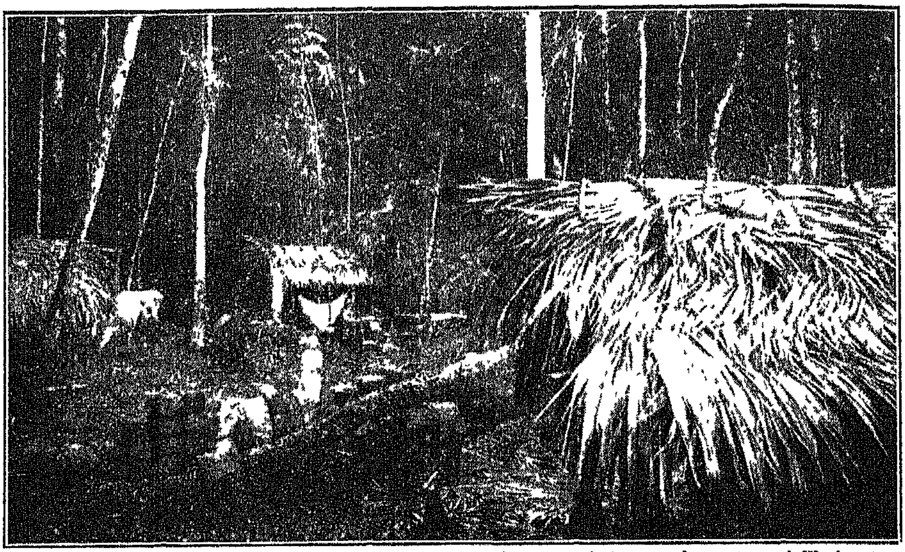
"The Jungles of Panama" — **C**, XLI (1922), 131–145.

"Why Hardwoods do not Grow Naturally in the West" — **N**, LIV (1924), 218.

One of the chief activities in temperate forest regions is "Hunting and Trapping" for furs, look up some of the following articles in **L**, I, "The Muskrat" (February, 1931), 44–48; "The Marten" (March, 1931), 44–48, "The Skunk" (April, 1931), 44–48, "The Raccoon" (May, 1931), 44–48; "The Otter" (December, 1931), 44–48, "The Mink" (January, 1932), 43–48, "The Beaver" (June, 1932), 42–48.

"The Fur Trapper" — 1, pp. 300–303.

[2] Numbers and letters refer to Selected References on pages 420–424



Courtesy of Carnegie Institution of Washington

A CHICLE CAMP IN NORTHERN GUATEMALA

FIG 201 Note the palm huts, pack mules, blocks of chicle to the left, hammock covered with mosquito netting under the hut in the center, and the dense, tropical rain forest beyond

# CHAPTER XX

# TROPICAL FOREST INDUSTRIES

Lumbering is extremely difficult in tropical forests The most common method of using these resources consists of collecting various products. This is the simplest type of forest industry, it is more rudimentary even than hunting or fishing. The gatherers merely search the forests for valuable plants, while the products require only simple preparation for shipment to market. As we have seen in the case of plantation agriculture, some parts of the tropical forest regions are given over to the cultivation of forest plants but the larger areas of tropical forests are homes of forest collectors (Fig. 201).

## FOREST GATHERING INDUSTRIES

Although forest-gathering industries are numerous, few have much importance. Gatherers take various parts of a plant. Roots are the basis for products like sarsaparilla. Trunks are tapped for rubber, *balata,* and wax. The bark is used for quinine Leaves make beverages, drugs, fibers, and thatch material. Nuts are gathered for food, buttons, and oil. Fibers surrounding seeds, like kapok, also are useful.

**A Season with a Chicle Gatherer.** How many of you, when chewing a stick of gum, have wondered where it comes from and how it is made? The

part of the gum that is left after the flavor is gone is chicle, made from the milky juice of the *zapote* tree.

Many *zapote* trees grow from Mexico and British Honduras to Brazil, but from the forests of northern Guatemala we get the best chicle Because the government owns these forests permission must be obtained to gather chicle. The juice, or sap, is gathered during the rainy season from May to October when trees give the most sap Perhaps two hundred men, some women, and a few children are in the larger camps called "*hatos*." *Chicleros*, as the collectors of the sap are called, are at the *hatos* only to get food or materials and to deliver chicle The rest of the time they are in the forests gathering sap From the *hatos* men cut a path into the dense forest that is swampy and thick with mosquitoes. The trees are scattered widely In the forest, the *chicleros* build a hut of palm trees in which two or three of them live while gathering sap.

*Courtesy of Carnegie Institution of Washington*

FIG. 202 A chiclero climbing and cutting grooves to obtain chicle in the forests of northern Guatemala.

This hut must not be too far away from the *hato* and must also be at a place where *chicleros* can easily reach it from their trees. When collecting sap, the *chiclero* travels alone. Each one has a part of the forest to cover. Early in the morning he makes a cut with his machete into the bark of the tree about eight inches from the ground, not quite circling the tree. He is careful not to cut all the way through the bark, for if he does the tree may die. He places a rubber or canvas bag, about one foot long and six inches wide, so that the juice from this cut will drip into it. The bag may be put on the ground and held in place by small sticks, or hung from a peg in the tree. Then with a rope loosely encircling both the trunk of the tree and his waist and with his bare feet against the bark, he climbs the tree, carefully making cuts with his machete. Each cut is joined to the one below, so the sap will run down into the bag. By the time he reaches the branches he will have made zigzag cuts in the bark all the way up the trunk.

The sap oozes from the cuts in tiny drops When it first comes out, it is white like milk, then it turns yellow and becomes thick. A full-grown tree may give thirty pounds of good chicle in a year.

Late in the day the *chiclero* collects his sap, takes it to his hut, strains

it, and puts it into kettles These kettles are about three feet across the top They are placed on stones over a slow fire (Fig 203) The *chiclero* mixes water and particles of a reed-like plant, which grows on the *zapote* trees, with the chicle Stirring the sap with a wooden paddle, he cooks the mixture until it is thick Still stirring, he lets it cool until he can work it with his hands as a baker mixes dough All this stirring and working with the hands keeps it from becoming lumpy The doughlike mixture is then put into wooden frames and molded into blocks. When cooled these blocks, weighing from twenty to fifty pounds, harden and are then wrapped in coarse canvas and taken to the *hato*

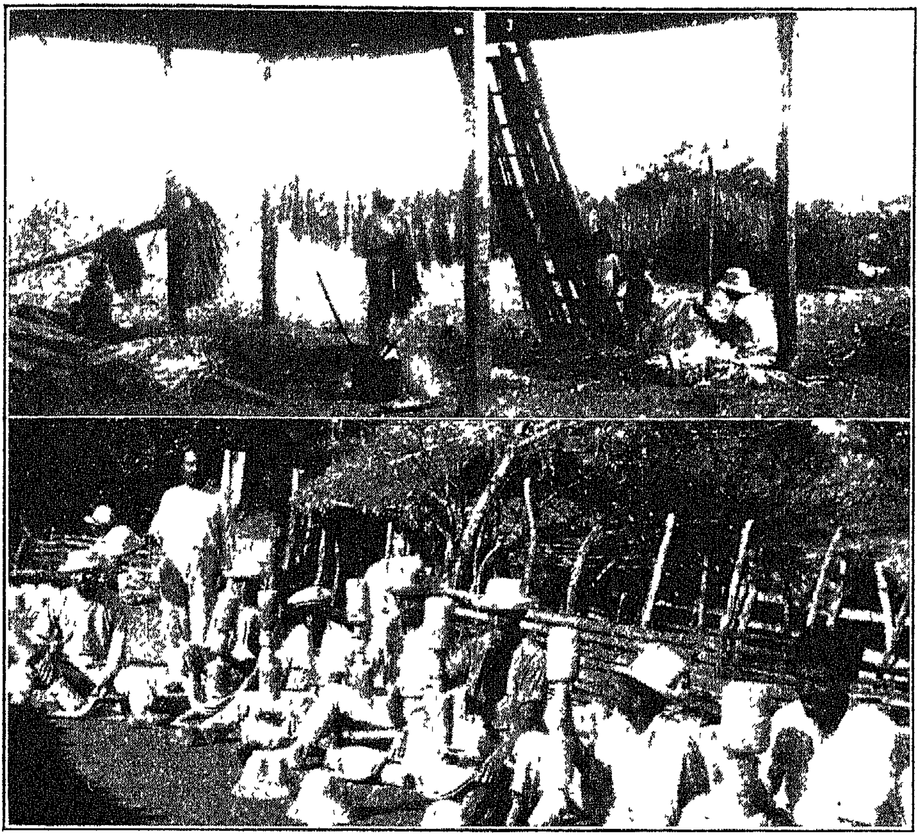
A *chiclero* gets $10 for every hundred pounds of good chicle That is better pay than any other laborers get. He usually earns $25 to $30 per month But he seldom has this money long. As soon as the chicle season is over, he hurries to town and quickly spends it all By the time another chicle season opens he has no money His employer loans him money to buy food and supplies to start collecting sap each new season

From the *hato* the chicle blocks are taken on mule back to rivers, thence by boat to ocean ports. Most of it is shipped to the United States. The chicle for which the *chiclero* received $10 at the *hato* costs much more when it reaches the United States Wrigley Company may pay $45 to $50 for the same amount of chicle The additional cost results mainly from the expense of transportation. In the United States the chicle is stored for a time. Then it is sweetened and mixed with water and some flavoring to form our chewing gum. One pound of chicle will make about four hundred sticks of chewing gum

**Wild Rubber and "Balata."** While the gathering of wild rubber has diminished in competition with plantation rubber, it has had the significant effect of developing other forest-gathering activities Rubber gatherers ranged far and wide over the extensive tropical forest areas and thus secured a knowledge of many useful plants In addition, the facilities provided for storing and shipping of rubber also have aided other industries

Wild *balata* has not become a plantation crop. The world's supply comes from the hot forests of South America, where in many districts it is the leading forest product The work is hazardous for gatherers are often bitten by snakes and the streams are full of *paranhias*, a dangerous, poisonous fish As the chief delivery season coincides with the rains and swollen rivers, it is common to have three or four men bitten each day when carrying *balata* to depots Yet, as *balata* is very valuable for making undersea cables and machinery belting, the men repeatedly face such dangers.

**Brazil Nuts.** Ranking next to rubber in the vast expanse of tropical forests in the Amazon basin is the gathering of Brazil nuts (p. 233). These delicious nuts had been gathered in a small way for a long time, but during the wild-rubber boom the natives preferred the rubber industry. When the rubber boom collapsed, the people again began to collect Brazil nuts and found ready markets in the United States and Europe. Most of the nuts come from the forests about Manaõs and Para, where the tree, known as the *castanheiro*, is a conspicuous giant on the well-drained uplands Unlike



MAKING PANAMA HATS, ECUADOR

FIG 203 After the palm fibers are cooked in boiling water for ten minutes to give strength and fix the color in uniform cream tint, they are hung on a line to dry, the sun then turns the straw a creamy white After the hats are woven by hand, men pound powdered sulphur into the hats with wooden mallets which smooth the straws Then the hats are bleached in sulphur fumes in an oven and later bleached more in the sun. An enormous amount of labor is required to produce a fine Panama hat

the case of wild rubber and *balata*, gathering the huge pods containing fifteen to thirty nuts does no direct harm to the tree since only the fruit of the tree is used. Besides, the tree occurs far and wide in abundance. Gathering is simple, consisting merely of going into the forest when the nuts have ripened enough to fall from their lofty perch in the tall trees.

**"Tagua" Nuts.** Over the Andes from the Amazon forests lie the rich Pacific forests of tropical South America. These contain many valuable resources The most important product is the *tagua* nut, known as "vegetable ivory." These nuts come from a small palm tree native to western Ecuador and Colombia They are of hard white composition, fine-grained, and greatly resemble genuine ivory They are used for making fine buttons. Wild animals are valuable partners in *tagua* nut gathering The nuts grow in a pulp-filled drupe containing from twenty to forty seeds. Rodents and

other wild animals like the pulp, eat it, and clean the nuts, which are then gathered by the natives

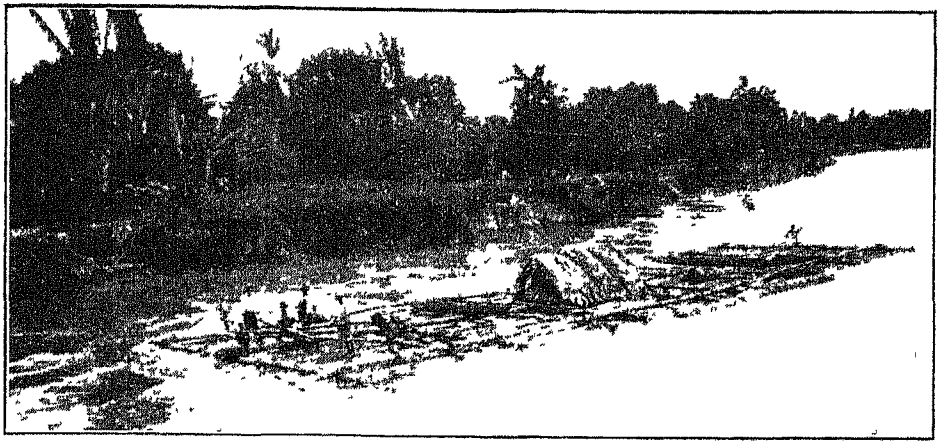
**Palm Nuts.** Africa's tropical rain forests are not so extensive as South America's, but today one of their trees, the oil palm, is the basis of the world's leading forest gathering industry While plantations threaten the wild product, the latter still has great importance The oil palm has long been one of the major sources of food for tropical Africa. Now it is not only so important in Africa, but in manufacturing regions its oil has many uses, such as soap, candles, glycerine, and margarine The oil palm gives Nigeria and Sierra Leone their leading export. The tree yields large crops and has two fruiting seasons In a year, a tree in full bearing has from twelve to twenty clusters of fruit, each cluster containing more than a thousand small fruits. The pulp is rich in oil and the native workers prepare the oil for market. In addition the nut contains a kernel also rich in oil Thousands of tons of the kernels are exported to manufacturing centers where efficient machinery extracts the oil.

**Panama Hat Fibers.** The gathering of the leaves of the *toquilla* palm, which grows in the Pacific forests of tropical South America, furnishes Ecuador with the fibers for its valuable Panama hat industry. The *toquilla* fiber industry represents a much more advanced stage of forest development than *tagua* nuts or Brazil nuts. The skilful natives exercise great care in separating and preparing the fibers (Fig. 203). Women and children generally do the weaving. It takes from ten days to weave the cheaper hats to three months for the finest hats. The weaving is usually done in the morning or in the evening when the moist air favors making the best Panamas These hand-made hats sometimes bring as much as $25 each in the hat store, but the native worker rarely gets more than a dollar or two for each hat

## LUMBERING IN TROPICAL FORESTS

To a person used to the forests of the United States or Europe, the variety of plants in tropical forests is astonishing Sometimes this great luxuriance produces what the botanist knows as "fourth-story" growth in which the "fourth story" consists of giant timber trees, the "third story" of slender and tall palms, the "second story" of thickets of bamboo and other tropical brush, the "first story" of a tangle of long vines, creepers, and epiphytes or plants growing in air Such a scene is paradise to the botanist and interesting to the traveler, but it represents one of the major obstacles to lumbering in tropical forests. Not only do the trees grow in scattered fashion, but tangles of underbrush block the way into the forest and quickly grow again after being cut. Most of the timber is very hard and heavy so that rafts of light woods are required to float many timbers (Fig. 204). The forests lie far from good transportation and centers of consumption.

Against these handicaps we have three main reasons aiding the development of tropical lumbering. First, the heavy rains that help the growth of such trees also produce great rivers, like the Amazon, which aid transportation. Second, the woods like mahogany, teak, ebony, and rosewood



LOG RAFT ON THE MAGDALENA

FIG 204. It takes months for these huge rafts to drift down the rivers hundreds of miles to coastal towns whence the valuable logs are exported

are of unusual strength and beauty and in great demand Third, labor is cheap. Nevertheless, as a rule it costs so much to bring the timbers even to the rivers that almost all present lumbering in these forests takes place near the sea coasts

**Mahogany.** Mahogany is the most important commercial tropical timber. This beautiful wood has many reasons to recommend it besides its beauty. It is prized as a strong resistant wood. Mahogany logs float in water. The mahogany districts all lie near water, for hauling the logs through the dense forests requires great effort. The chief mahogany lands are those about the Caribbean Sea, the finest wood coming from the Dominican Republic. It is the leading industry of British Honduras. Hot, moist west Africa also produces mahogany.

Mahogany lumbering well illustrates the troubles of tropical lumbering. In the tropical countries the people call it mahogany-hunting. If the mahogany hunter finds one tree to every acre or two, he is lucky. To find even that one he has to climb the tallest trees, usually a mahogany itself, in order to look over the thick lower "stories" and locate other mahogany trees rising above the forest Then he has to cut his way to the trees In some places the logs are left on the ground until the rainy season, when floods may float them Otherwise pathways must be cut in the thick brush to the river and the logs dragged to water and floated in rafts In the African forests, the tse-tse fly makes it impossible to use draft animals, so one may see hundreds of sweating natives lugging the often enormous logs to the rivers As one log may bring in several hundred dollars, one can understand why men will work so hard in these forests

**Tropical Cedar.** Cedar wood from tropical forests ranks next to mahogany in commerce. Many varieties have the name cedar, but in general they are alike in qualities of softness, workability, lightness, and fragrance. The leading districts lie about the Caribbean, in the Amazon basin, and

in western Africa. Large quantities are shipped to manufacturing centers for use in cigar boxes, pencils, and chests. Unlike most tropical timbers, cedar has important markets in the tropical countries, because of the ease with which it is worked. In some places, however, where cedar does not grow, the lumber districts import wood from temperate forests. Moreover, even where the cedar grows, lumbering may be so difficult that it is cheaper to import. Cedar constitutes the general purpose wood in many tropical forests.

**Teak.** Teak lumbering is one of the most picturesque of tropical industries, but also one of the most difficult. On the average it takes four years from the time a teak tree is cut until it reaches a foreign market. Yet the industry has much importance in India, Siam, and Java, because the wood has several unusual qualities. Its greatest use is in boats, for the wood contains an oil which prevents rusting of iron as is the case of other woods when in contact with iron. Besides, it is fire-resisting and resistant to the attacks of white ants.

In preparation for felling, huge trees are girdled. The trees soon die and lose much weight upon drying. If this were not done, the logs would sink in water. This first step takes about three years. When felled, if near rivers they are pulled to the streams by intelligent elephants, one company having twenty-five hundred powerful beasts. If far from streams, the logs are moved to areas which will be flooded in the rainy season. Then they are collected in rafts and floated to the ports, the main ports being at the mouth of the Irrawaddy, Salween, and Menam rivers. Teak wood is a major export of Burma and Siam.

## EXERCISES

1. (*a*) Make a list of the products gathered in tropical forests. (*b*) Locate the forests in which each is gathered. (*c*) Locate the chief market regions of each. (*d*) Do we produce any of these products?

2. (*a*) List the difficulties the chicle gatherer must cope with. (*b*) Describe the process of caring for the sap from the time the chicle tree is tapped until it reaches Chicago.

3. (*a*) What are the principal tropical trees cut for lumber? (*b*) For what are they used? If you live near a lumber company or furniture company, you may obtain a sample of these woods. (*c*) What properties make them so valuable?

4. Make a list of the difficulties of lumbering in tropical forests.

5. Why do tropical forests have a sparse population?

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"Rubber Gathering" — 17, pp. 270–272, 502–508; 97, II, pp. 710–712; 32, pp. 13–14; 33, No. 15, pp. 1–18.

"Tagua Nuts" — 17, pp. 523–524, 548–549; 97, II, p. 763; 33, No. 21, pp. 1–15; G, XXXVII (1913), 192–208; G, LXII (1928), 801–809.

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"The Philippine Lumber Industry" — A, V (1929), 194–202.

[1] Numbers and letters refer to Selected References on pages 420–424.

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"Tropical Hardwoods and Their Use in American Industries" — **G,** LXI (1927), 219–227

"From Tagua to Buttons" — **33,** No 21, pp 1–12, **G,** LXII (1928), 801–809, **5,** pp 289–290

"Brazil Nuts, Palm Nuts and Other Forest Products Gathered" — **33,** No 5, pp 7–10, 13–14, 16, 20–24, 28, 29

"A Day's Work with a Rubber Gatherer in Brazil" — references above and **L,** I (January, 1932), 13–18, **33,** No 15, pp 7–18

"Mahogany — King of the Tropical Forest" — **L,** I (February, 1931), 14–19

"Making Panama Hats" — **G,** XXXIX (1914), 685–693, **17,** pp. 524–526.

"Kapok" — **5,** pp 336–337; **17,** pp. 53, 421, 517, 548, 563, 620

Save the wrappers of your gum and write to the company asking them for printed material on the sources of their raw material and processes of manufacture

"Problems of Teak Lumbering" — **H,** II (1931), 325–333, **27,** pp 205–208, **8,** Chapter X, **C,** LVIII (1930), 239–256

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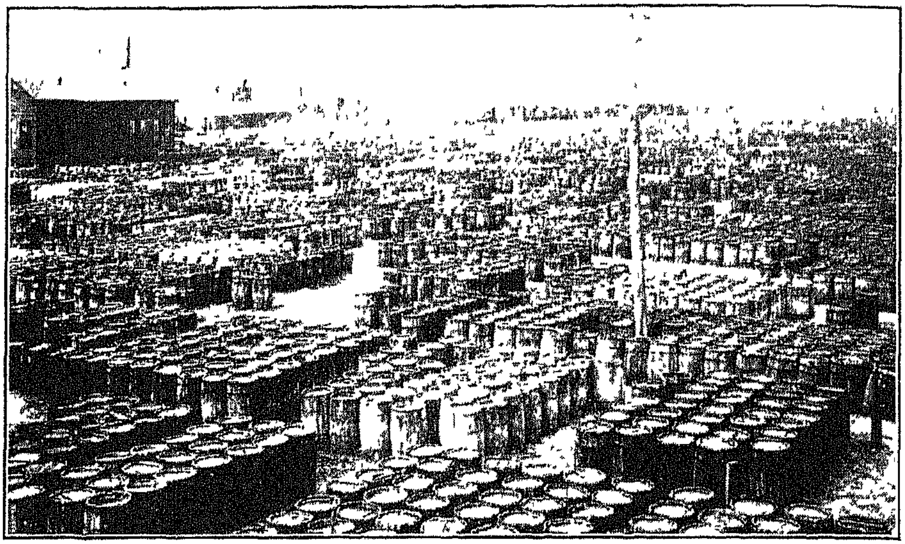


*Courtesy of United States Forest Service*

NAVAL STORES, SAVANNAH, GEORGIA

FIG 205 The turpentine and rosin of the southern forests move through a few ports of the south to other regions for use

CHAPTER XXI

# NAVAL STORES, DRUGS, AND OTHER FOREST PRODUCTS

In addition to the forest products discussed in preceding chapters, there are many others. Naval stores, drugs, tanning materials, cork, and others are produced in many distant regions The regions that produce them use little. The United States and the countries of western Europe produce small amounts of most of them but they buy nearly all the exports of distant regions

What are naval stores? If you should try to find an answer in the uses of most products which are called naval stores, you would be disappointed. In the days of wooden vessels, naval stores meant the tar and pitch obtained from various resinous pine trees in the southern states that were used to close the seams between planks. Now naval stores mean mainly turpentine and rosin, neither of which has as much direct connection with naval matters as with other industries (Fig. 205)

**A Turpentine Still and Turpentining.** The extensive pine forests, which cover large parts of the cotton-belt states and Florida, contain a number of kinds of resinous pine trees; the most useful is the longleaf pine. In many parts of these forests, especially in western Florida and southern Georgia, one sees many "turpentine stills." These stills consist of a few buildings sheltering machinery to change the resin, obtained by tapping the trees, into turpentine and rosin. The

buildings are poorly made because the industry is generally so destructive to the forests that the stills have to be moved every few years In the cleared space about the buildings will be thousands of barrels, some containing the undistilled resin, others the naval stores Nearby, also, will be a railroad siding to carry away the heavy barrels for shipment to manufacturing centers both in the United States and in foreign countries This country produces most of the world's supplies of naval stores France ranks second

In the surrounding forests are many regions of "turpentining"—gathering the resin which flows from cuts made in the tree trunks In the early days, the method of cutting was very destructive, a tree usually dying after five years of giving resin The workers would chop a shallow "box" in the trunk at the base of the tree and above the box would cut V-shaped wounds to guide the flowing resin. From time to time the workers scooped out the resin from the box Now most of the resin is obtained more carefully, somewhat in the manner of tapping rubber trees, and the trees yield for a much longer time (Fig. 206).

At the still the resin is heated to distil the turpentine, while the rosin remains in the kettle as a residue The barrels of turpentine and rosin go mainly to the ports of Savannah, Charleston, Jacksonville, Pensacola, and Mobile, where they have the advantage of cheap ocean transportation to northern manufacturing centers. Turpentine has many uses in paints and varnishes and in a great variety of industrial chemicals. Rosin is valuable in the manufacture of soap, paper, protective coverings, and many chemicals.

**Naval Stores in France.** The French naval stores industry serves as a good lesson in the conservation of resources In southwestern France lies an area called the Landes One hundred fifty years ago this was a sandy waste, unproductive, unhealthful, and almost unpopulated. Besides, moving sand dunes bordered the coast and continually destroyed villages and forests The country undertook to make this region useful It planted resinous pine trees on the dunes to hold the sand in place, and it drained and planted the rest of the area. Now the Landes is a vast pine forest, where naval stores and wood are the major products, supporting one and one-half million people

The French conduct turpentining very carefully and while a tree does not produce so much at a time as the American longleaf pine, it may be

*Courtesy of United States Forest Service*

TAPPING A TURPENTINE TREE

FIG. 206 The modern method of chipping for the cup system allows the tree to live and produce much longer than the old box method.

tapped for forty years or more. When the trees are seventy years old, they are cut for timber and new trees are planted to take their place, thus assuring a constant supply of naval stores and wood.

## DRUGS

The forests of the world, particularly those in warm lands, produce many useful drugs. In some districts, the gathering of such drugs is a major occupation. Two of the most important are camphor and quinine.

**Camphor.** Camphor remains the leading drug still obtained chiefly from wild trees. On the mountain slopes of Japan proper, Formosa, and southern China the camphor tree grows wild. The industry is so valuable in Japan and Formosa that the government regulates it and owns much of the forests. Attempts have been made to start camphor production in Florida, Texas, and California. As yet, Japan and Formosa supply most of the world's output, Formosa leading the world. To obtain the camphor the trees are felled, chopped into small pieces, and the camphor distilled from the wood over boiling water. While transportation in the mountains is difficult, camphor oil and crystals are so valuable that it pays to carry on the industry. A single tree may yield more than $5000 worth of camphor.

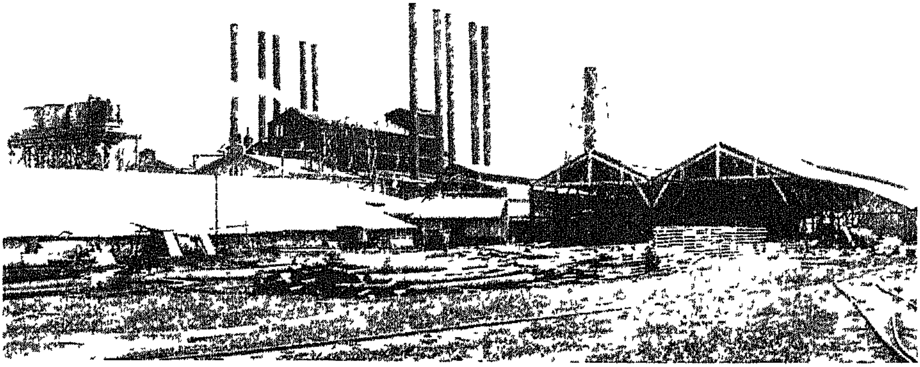
**Quinine.** Quinine is obtained from the bark of the cinchona tree. Until 1880 the South American forests, primarily those of Colombia, Ecuador, and Bolivia, produced most of the world's quinine. In these countries the industry has had many tragedies, most of the trees being chopped down and the bark stripped off. Also, the natives were mistreated. In spite of abuses, the South American forests still have many trees. So crude were the shipments that the British and Dutch started their own industries on plantations in Java, India, Ceylon, and Madagascar. Now Java turns out most of the world's quinine from scientifically managed plantations.

## TANNING MATERIALS

All plants contain varying amounts of tannin, a substance which when properly applied to hides of animals makes them durable, strong, flexible, impervious, and protected from decomposition. Only a few plants contain enough tannin to make their use profitable. In some trees the tanning materials come from the heart wood, as in the chestnut and South American *quebracho*, in others from the bark, as in the hemlock, oak, mangroves, acacias. Still others produce tannin in seeds and leaves.

On account of the simplicity of tanning, it is one of the most widespread industries, each district using its local tanning material so far as possible. In the industrial centers of western Europe and eastern North America, however, the business has grown so large that huge quantities of tanning materials are imported. Only the United States and France, among leading manufacturers, have large domestic supplies. Recently minerals have captured many markets from forest tanning materials, but the latter still are of much importance.

**"Quebracho."** This is the world's greatest source of tannin today. All of it comes from the Chaco in South America, where the tree grows in open forests over a large area. Argentina produces most of the *quebracho* logs



*Courtesy of Pan American Union*

A TANNIN EXTRACT FACTORY PARAGUAY

FIG 207 The large quebracho logs go into the chippers and later come out as tannin The location of the forests near the streams and the factories on the rivers affords cheap transportation to Buenos Aires, the chief export point

and extract, the industry being that country's main forest activity In Paraguay, although the production is much less than Argentina's, *quebracho* gives the country a leading export.

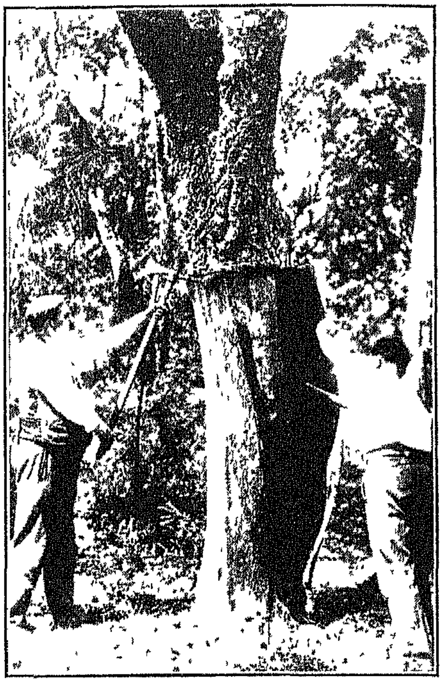
The great value of this tree lies in the fact that it has an unusually high tannin content, twice as much as hemlock which is so important in northern countries This explains why a region so far from tanning centers has such a large industry Fortunately the trees grow near the navigable Paraguay River and the products can be shipped downstream to Buenos Aires for export On the other hand the industry has many handicaps, such as poor land transportation, floods, droughts, inefficient labor, mosquitoes, sand fleas, and forest fires.

In early days the lack of facilities made it necessary to send the *quebracho* logs all the way to Europe or North America for extraction of the tannin. Thousands of logs still are sent. But most of the trees cut are chopped up at huge extract factories located on the rivers, and the chips treated to extract the tannin (Fig 207). Most of the extract and logs go to Europe, but one-third of the United States' supply of tannin also comes from the Chaco

**American Tanning Materials.** Most of our tannin comes from the forests of the eastern states These forests were the richest in the world in tanning materials, hemlock, oak, and chestnut were the principal sources Destructive methods have undermined the industry, millions of fine oaks, for example, being cut only for the bark Oak bark is important both because of the quantity used and its excellence The oak bark industry belongs now mainly to the southern Appalachians For a long time hemlock bark was the principal source of tannin. The hemlock bark industry is in the northeastern states where this tree finds suitable cool climate The third major source of tannin in the United States was chestnut wood. In recent years the chestnut blight has killed out most of the trees. However, Vir-

ginia and North Carolina still produce some tannin from chestnut wood In the Far West, the tanbark oak is important and the western hemlock is considered as a future source of tanning materials

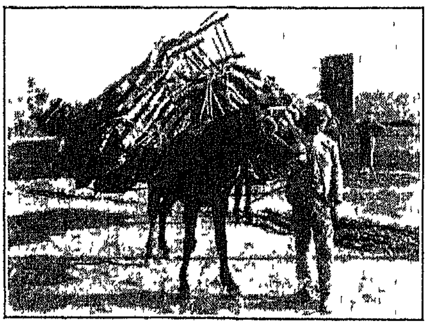
**Minor Tanning Materials.** Besides these more commonly used tanning materials, several others enter commerce, mostly going to Europe. Mangrove bark has had much value in recent years, for it yields twice as much tannin as *quebracho,* but it lends an undesirable color to the leather Most of it comes from Mozambique and tropical South America *Myrobalans,* the dried fruit of a tree of central India, furnish India's chief tanning material and also are sent in large quantities to Europe *Divi-divi* seed pods come mainly from Venezuela and are used extensively in Germany. *Sumac,* of the kind growing in Sicily and southern Italy, is used to tan fine leathers. *Valonia* is the name for the acorns of the Turkish oak, which are very rich in tannin.



*Courtesy of Armstrong Cork Company*

STRIPPING CORK

FIG 209 If the thick bark is stripped carefully, no injury is done to the tree. A tree does not yield high-grade cork until it is about forty years old The bark is taken to a boiling station where it is boiled to remove the tannin, add elasticity, make it soft, and flatten the cork.



*Courtesy of Armstrong Cork Company*

FIG 208. BRINGING IN CORK FROM THE COUNTRY

## CORK

The cork industry is one of the most valuable of forest industries other than lumbering and is practically confined to the western Mediterranean region. Most of the cork comes from Spain and Portugal and the rest chiefly from Algeria and Morocco (Fig. 208). For Spain cork is the fourth export, for Portugal, third. The value of their combined shipments is twice as great as those of Argentine *quebracho.*

The cork oak grows without cultivation in some of the poorest sections of the region. Once a cork grove is established it produces for a long time; trees live to be one hundred fifty years or more old. It is a good crop for poor rough land, but it is hard to establish a plantation. A tree must be about twenty years old before

it gives its first cork, and the first stripping is of little value The bark is stripped off every ten years (Fig 209)

Several factors account for the high value of cork, so high that it is a good industry for remote or inaccessible places More than half of the cork, usually the waste from cutting bottle stoppers, goes into refrigerators and cold storage plants as insulation, for cork does not conduct heat easily. As it is light in weight, it has a large market in life preservers It is compressible and impervious to liquids and therefore excellent for bottle stoppers It has great durability in proportion to its weight Select the factors which make cork useful also for linoleum, linings for hats and shoes, stuffing for cushions, washers, and gaskets, fishing rod and bicycle handles, and helmets worn by white people in hot sunny climates.

## EXERCISES

1 As you study the chapter, place on an outline map of the world the following products in their natural habitat and by means of lines and arrows indicate their chief movements in world commerce resin, camphor, quinine, *quebracho*, tannin materials (hemlock bark, oak bark, mangrove bark, *myrobalans*, *divi-divi*, *valonia*, cork)

2. From a study of the maps pp. 12, 14, 62, 63, and 193 write out the conditions which foster the extensive stand of evergreen trees in parts of the cotton belt and Florida

3 Contrast the turpentine industries of the southern states and of France, show how the French industry is a lesson in multiple conservation.

4 From a study of the pictures pp 233, 236, and 238 contrast the turpentine forests with the tropical rain forests

5. From the maps pp. 11, 13, and 15 work out the conditions that are favorable for the camphor industry of Formosa

6 List the conditions that caused a shift from wild quinine in South America to cultivated quinine in the East Indies

7 (*a*) What conditions favor the *quebracho* industry of the Chaco? (*b*) Make a list of the trees by continents from which tannin is obtained.

8 Why is cork a good product for the western Mediterranean region to produce?

## AN EXTRA LESSON

For three honor students to present to the class

"The Wild Plant Industry of the Southern Appalachians" — A, VIII (1932), 311–317

"Yerba Mate" — 17, pp. 290–292, 319–321, 434–436, 33, No 4, pp 1–23, B, XXIX (1930), 54–70.

"Coca and Cocaine" — 17, pp 222–223, 249, 256–258, 33, No 20, pp 3–19.

## READINGS [1]

"The Turpentine Forests and Industry" — 1, pp. 83–85; 7, I, pp 156–158, C, L (1926), 298–305, L, I (December, 1931), 13–18

"Landes Reclaimed Waste Lands of France" — A, II (1926), 249–255.

"Naval Stores Industry" — 98, No 229, pictures, 97, II, 546–548.

[1] Numbers and letters refer to Selected References on pages 420–424

"Quebracho" — **104**, No 295, **17**, pp 286–290, 326–328, **G**, LIV, (1922) 9–34, **33**, No 9, pp 1–36

"The Cork Industry" — **B**, XXV (1926), 241–248, **7**, II, pp 485–487; **82**, pp 170–172, **100**, Vol III (August 24, 1927), 542–544.

## TOPICS FOR INVESTIGATION AND REPORT

"Wattle Culture" — **104**, No 211

"Mangrove Bark" — **104**, No 167, pp 1–2, 4, 5, **33**, No 6, pp 7–10

"The Valonia Industry in Turkey" — Special Circular, No 514, Hide and Leather Division, Bureau of Foreign and Domestic Commerce, Washington, D C

"Divi-Divi" — **33**, No 6, pp 17–18

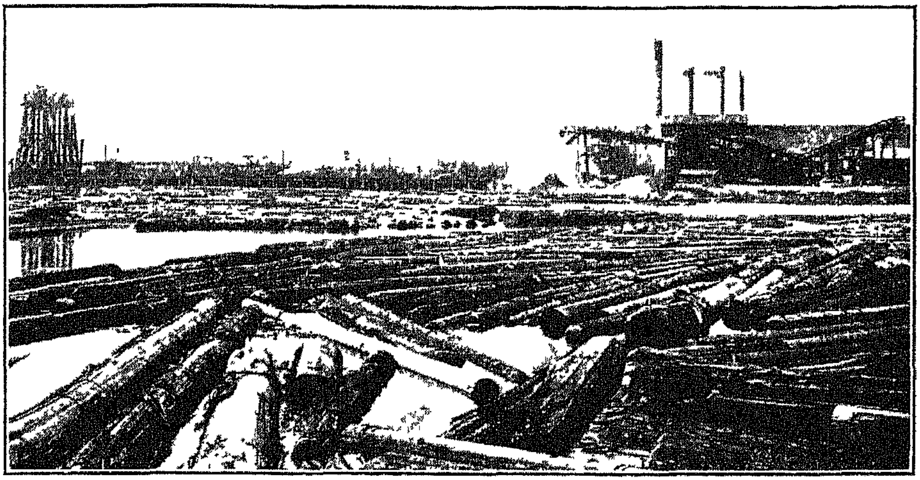
"The Camphor Industry" — **C**, XXXVII (1920), 263–272, **27**, pp 124–125, **97**, I, pp 447, 450

"Maple Syrup and Sugar" — **A**, VIII (1932), 35–39, **L**, I (March, 1932), 13–18

"Paraguay's Oil of Petit-Grain" — **G**, XLVII (1918), 534–541

"Quinine Production" — **104**, No 273, **82**, pp 194–195

"Searching for the Chaulmoogra Tree of Siam for a Cure for Leprosy" — **C**, XLI (1922), 243–276, many pictures, giving excellent views of the forests



Courtesy of United States Forest Service

FIG 210 HUGE SAWMILL, TACOMA, WASHINGTON

CHAPTER XXII

# LUMBERING IN TEMPERATE FORESTS

## § I — NORTH AMERICA

**A Sawmill on Puget Sound.** The state of Washington produces one-fifth of all the lumber cut in the United States, a quantity greater than that cut by the next two states combined. It has the finest sawmills in the world. A visit to one of the many located on Puget Sound tells us much about the geography of lumbering. Let us choose one near Seattle, the largest city in the Pacific northwest and, like most other cities of the region, greatly interested in forest industries

The size of the lumber mill property is tremendous, the log and lumber yards covering many acres (Fig 210) There is a great concentration of transportation facilities. The mill has a deep water channel in which are a picturesque sailing vessel and a less picturesque but more efficient tramp steamer loading lumber Railroad tracks criss-cross the yards. On some of the tracks are flat cars loaded with huge logs, on others box cars containing sawed wood. Huge motor trucks bring logs and leave with lumber. The logs go to a large storage pond, to float until needed at the mill, in the pond is a huge raft of logs brought down the coast by tugs. These huge mills must have fine facilities for moving their heavy raw materials and manufactured products

Besides their fine transportation facilities, these mills have wonderful machinery to handle and cut logs more than six feet in diameter. Almost everything is done automatically A few men controlling push-buttons and levers control great saws, some circu-

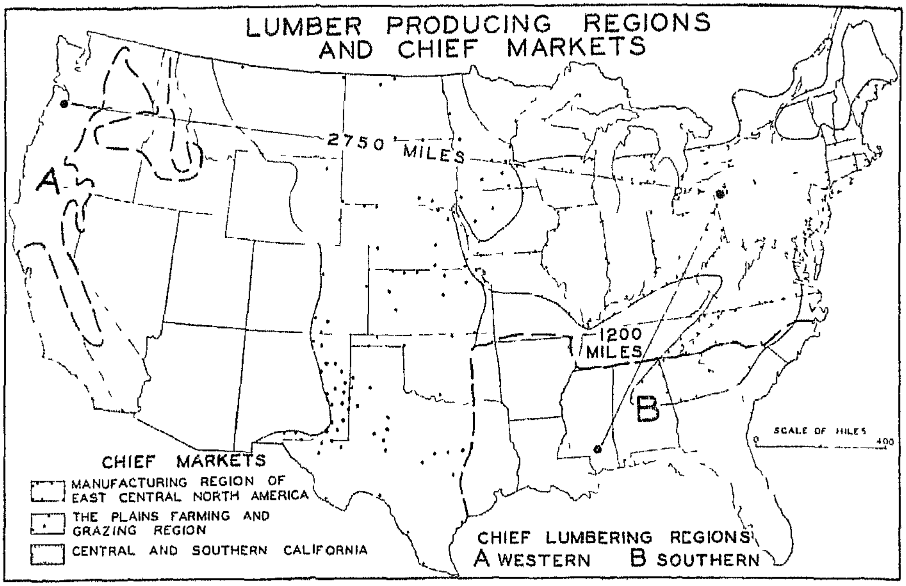
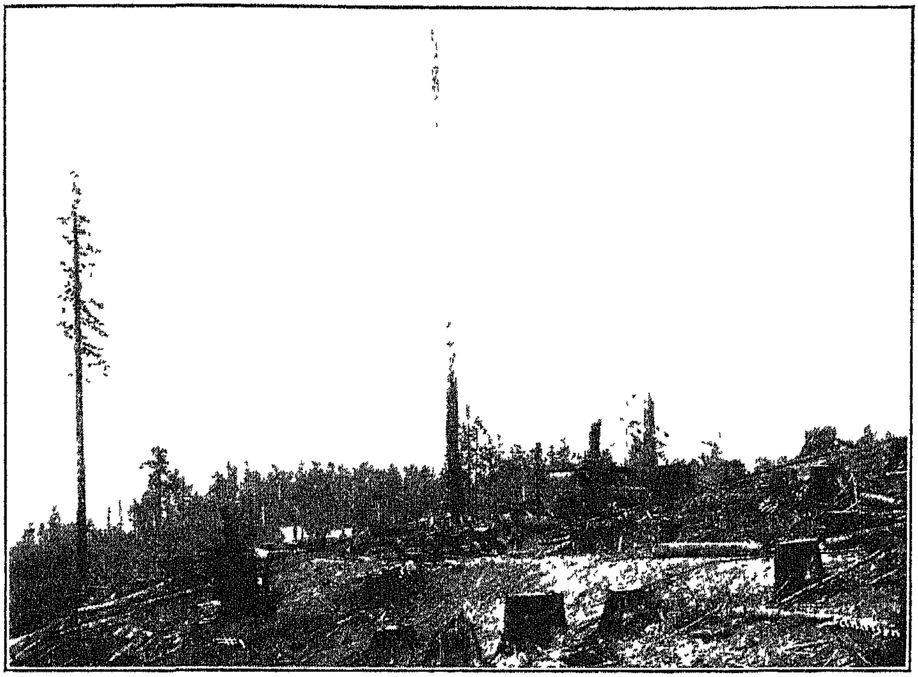



FIG 211 The United States' portion of the manufacturing region of east central North America consumes more than half of our lumber, it has a great railway mileage, numerous ports, one-third of the farms of the country, most of our coal mines, and a large percentage of our population The plains farming and grazing region, the second great market, has almost no trees, many miles of railway, and many people Why are central and southern California large consumers of Pacific coast lumber? Why do areas A and B produce nearly three-fourths of our lumber? How does lumber move from areas A and B to the consuming regions?

lar and some endless bands. A few minutes after a giant log enters the sawing machinery, it leaves in many pieces of various shapes, some being carried to other machinery for further cutting, others to the yards for storing, the waste to furnaces and waste fires — all automatically It takes an enormous amount of logs to keep such a mill going, but wood is so abundant nearby and has so many uses that there are many equally large establishments. Indeed, many people think that too many sawmills are cutting our forests too rapidly

**The Pacific Forests.** The forests which supply these great lumber mills are the world's finest source of useful wood. They are now the main supply of the United States (Fig. 211). While the Pacific Coast forests cover a large area on the slopes of the coastal ranges north of San Francisco, the Sierra Nevada, and the Cascade Mountains, and extend as far north as Alaska, they have the significant advantage of containing only a few species of trees. The valuable species are coniferous soft woods, including the majestic Douglas fir which reaches a diameter of six feet or more and a height of over two hundred sixty feet. Not only does this fine tree reach so great a size, but sometimes it grows in such close ranks that it makes up nine-tenths of the trees in a district. It has strong, durable wood of medium weight, and lends itself to all kinds of construction. Almost one-fifth of all the lumber cut in this country is Douglas fir. Other excellent timbers are the western yellow pine, western



*Courtesy of Chamber of Commerce, Bellingham, Washington*

A "SPAR TREE" WITH CABLES ATTACHED

FIG 212 A "spar tree" is used to drag the logs within a large radius A donkey engine at the base, by means of cables through the pulley on top, drags the logs to the base of the tree to be loaded As the logs are pulled in they break small trees. This is known as "high lead" logging Another method uses two "spar trees" and two cables, one on which the logs ride and one which pulls them Cables are of steel wire, often one and three-fourths inches in diameter At times railways are built straight up the slope and the logs let down on cars by means of cables More often temporary railways wind up the steep slopes

red cedar, many firs, western white pine, hemlock, Sitka spruce, and the gigantic redwood of the California costal ranges.

**Logging.** In getting such trees from the forest to the lumber mill man has to solve many problems. These include the size of the trees, their closeness, rough topography, and the lack of convenient means of transportation, such as snow and long rivers, which benefit the forest industries of the northeastern states

In the Pacific forests the lumberjacks use great hand saws to fell the trees (Fig. 212). The branches are then cut off and the trunk divided into lengths suitable for a flat car Often a single length or log requires an entire flat car Powerful stationary engines pull the logs by cables to the railroad. Rivers in this section cannot be used to transport the logs, they do not freeze, there is little snow in winter, and the rivers have many falls and rapids. Consequently, railroads and trucks carry most of the logs to the sawmills located chiefly in lowlands near the sea While railroads involve much expense as they have to cross mountainous country, the wealth of the forests makes them useful for

many years Proximity to the sea is a great advantage in this region, for log rafts may be sent to distant mills located where ocean vessels can call for lumber

**Lumbering in the Rocky Mountains and the Colorado Plateau.** Where the mountains of the western interior rise high enough to have a heavy rainfall, there are forests of considerable importance. They have much less value than the Pacific forests, as they cover less land, the trees are smaller and more scattered, and they do not have the excellent coastal transportation facilities (p 272). Here also the coniferous soft woods predominate, the principal trees being the western yellow pine, Douglas and other firs, western larch, spruce, and lodgepole pine Logging is somewhat easier than farther west, but the disadvantages already mentioned retard development and the comparative aridity makes forest fires much more dangerous than along the damp Pacific coast

**Lumbering in the Southern States.** The forests of southeastern United States for many years led all others in production and today rank next to the Pacific forests. Southern yellow pine is still the most important wood in this country, accounting for nearly one-third of the country's output Unfortunately, the need for agricultural land and careless methods of logging have caused the southern lumber industry to decline rapidly Twenty years ago it produced twenty billion board feet, now less than fourteen billion, chiefly yellow pine and considerable cypress and gumwood from the swamps.

Another reason for the rapid destruction of these forests is the ease with which lumbering is done. Compared to the Pacific forests or tropical forests, lumbering here is easy The trees, mainly longleaf, loblolly, slash, and shortleaf pines, form extensive pure stands not too closely spaced The wood is easily worked and has many uses The land is almost all level. Rivers are many Population centers are near The climate permits year round work and cheaper dwellings for workers than in the northern forests Moreover, some of the pines also give valuable naval stores before being cut

Some southern lumber mills rival the huge plants on the Pacific coast. Like the latter, they combine land and sea transportation facilities in an effective way Also in this region we find many small mills, for the forests are so distributed over vast areas that it is easy to set up the equipment These small mills are moved as the surrounding forests are cut Moving has become difficult, because the owners of the huge, more or less permanent mills have bought up much of the forest land

**Lumbering in the Central Hardwood Forests.** In the belt of deciduous hard woods, between the northern conifers and southern conifers, lumbering takes a different form This area furnishes almost all of the hard wood used in the United States and is the basis for the important furniture industry. Most abundant and of greatest economic value are several kinds of oak, in the Appalachians comprising one-third of the forest Chestnut, hickory, yellow poplar, elm, black walnut, and ash add to the list of useful hard woods and in some places there are conifers of importance. Usually the trees occur in

much variety, which makes logging more difficult than in the coniferous forests Moreover, the best stands now lie in rough areas, as in the southern Appalachians.

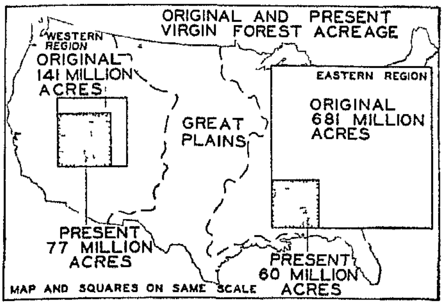



FIG 213 What percentage of our eastern virgin forest area remains? What percentage of our western? What percentage of our total virgin forest area remains?

A large part of the original hardwood forest was cut to provide farmland (pp. 264 and 273) The demand for tanbark added to the destruction. As a result, the hard woods necessary for furniture making have become costly, and commonly, instead of using solid pieces of such wood, thin veneers of attractive grain are used to cover cheaper supporting wood The remaining forests probably will not suffer so rapid a destruction, for the government has begun to set aside large portions as national forests. This has been done chiefly to prevent floods and soil erosion. In mountainous regions, forests act as regulators of stream flow; if forests are removed, rain waters run off rapidly, flooding valleys and destroying valuable farm land by carrying off the soil

**Lumbering in Northeastern Forests** In the early history of the United States the belt of coniferous forests stretching from Minnesota to Maine played a significant part, especially the forests of New England. These forests were located so favorably with regard to rivers and sea that early shipbuilding was highly stimulated and the colonists also shipped lumber to Europe. So rapidly did the people cut the forests, not only for lumber but also for farmland, that the lumber industry of the United States began a migration which has now reached a final stage in the Pacific forests (Fig. 213). From New England, the lead passed to New York around 1850, then it went to Pennsylvania, Michigan, Wisconsin, Minnesota, the south, and finally to the Pacific Now the entire northeastern forest produces only one-fourth as much lumber as the Pacific area. Lumber from the Pacific region predominates in the Great Lakes lumber yards and has much importance even on the Atlantic coast.

*Courtesy of United States Forest Service*

A SPRING LOG DRIVE

FIG 214 In New England the great spring log drives are largely a thing of the past, but in the forests of eastern Canada, they are the chief means of bringing the logs from the forest to the sawmill or pulp mill, they are quite common in parts of the Rocky Mountain forests Why are drives not common in the Pacific forests?

Much of the original forest consisted of mixed conifers and deciduous trees, but the conifers were the basis for the lumber industry. White pine, one of the finest of all timbers, was

the leading tree, but the demand soon caused most of it to be cut. Now spruce and fir predominate, followed by white pine, cedar, and hemlock A large part of the activity in these forests today is in connection with the paper industry

Work in these forests differs considerably from that in the other major forest regions. It has one useful advantage, the winter snows, which facilitate moving the logs by use of sleds drawn by horses or tractors For many districts, railroads carry away the logs, but some still float them downstream When streams are used for transportation, logs are piled up on the banks of frozen streams in winter. When the ice melts in the spring, thrilling "spring drives" occur, about which all of us have probably read The drives consist of getting logs into streams and down their racing waters to the mills, a dangerous task (Fig. 214). This practice has become less frequent because many forests near rivers have been cut, power dams make floating less easy, and consequently railways carry many logs

## EXERCISES

1 Write a description of a large sawmill on Puget Sound, giving the reasons for the location of the mill and how lumbering is carried on

2 Make a table of lumbering in the forest districts of the United States according to the following

| | *Pacific* | *Rocky Mountain* | *Southern* | *Central Hard Woods* | *Northeastern* |
|---|---|---|---|---|---|
| Relief | | | | | |
| Rivers | | | | | |
| Climate | | | | | |
| Kinds of trees | | | | | |
| Logging methods | | | | | |
| Density of population | | | | | |
| Chief products | | | | | |
| Chief markets | | | | | |

3 Now list the physical conditions that require different methods of lumbering in the Pacific forests than in the northeastern forests.

4 (*a*) Answer the questions on Fig 211 (*b*) Write out the relation between relief, rainfall, and sandy areas and the chief forest regions of the United States (pp 10, 12, 14, 193, and 273).

5. Give several reasons for the large consumption of lumber in each of the chief markets (Fig. 211).

6. Give several reasons to show why lumbering in the southern forests is easier than in tropical forests.

7. Where would the use of wood be the chief fuel for home fires? (*a*) In western Pennsylvania? (*b*) In northern Michigan? (*c*) In Kansas?

### AN EXTRA LESSON

"A Detailed Study of Lumbering in the Northwest" — 12, pp 150–169, 98, No. 711.

### SUBJECT FOR A DEBATE

Resolved: That the National Parks should follow the policy of the National Forests in cutting old and mature trees.

## READINGS[1]

"Our Different Forests" — 86, pp 182–201, 23, pp 450–466

"The Relation of Geography to Timber Supply" — A, I (1925), 1–14.

"Forests and Lumbering in the Pacific Northwest" — A, VIII (1932), 305–308, P, LX (February, 1933), 35 ff.

"Our Logging Industry" — 8, Chapters 8 and 9

"Lumbering in the Yellow Pine Region of California" — Professional Paper No 440, United States Department of Agriculture, Washington, D. C, 1917.

"The Forests of the South" — 1, pp. 80–85, A, VI (1930), 94–98.

"Life in a Southern Sawmill Community" — B, XXX (1931), 181–189.

"Glimpses of Our National Parks" — 35

"Forest Products of Canada" — H, I (1930), 379–401, excellent pictures, C, L (1926), 431–440, pictures

"A Primer of Forestry" — 101, No. 173

"The Lumber Industry" — a general reference — 93, pp 470–502

## TOPICS FOR INVESTIGATION AND REPORT

"Evolution in the Use of Our Forests" — A, I (1925), 1–14.

"Falling Giants of the Northwest" — 1, pp 208–221

Some special articles on trees in L, I, "The Walnut Tree" (January, 1931), 16–22, "Goodbye, American Chestnut" (March, 1931), 14–19; "The White Pine" (April, 1931), 13–18, "The Spruce — for Gum Paper and Christmas" (May, 1931), 14–19; "The Sturdy Oak" (February, 1932), 13–19; "California Redwood" (May, 1932), 13–18; "American Cypress" (June, 1932), 13–18.

"The Forests of Canada" — A, II (1926), 394–413

"Lumbering in the Northeastern Forests" — 1, pp. 326–337

"Opportunities in Park and Forest Work" — M, XXX (1932), 187–190

"Grand Rapids Furniture Capital" — L, I (January, 1932), 25–30.

Write to the Southern Pine Association, New Orleans, Louisiana, for information and pictures of the lumber industry of the south. Use them as a basis for a class report or for a special project.

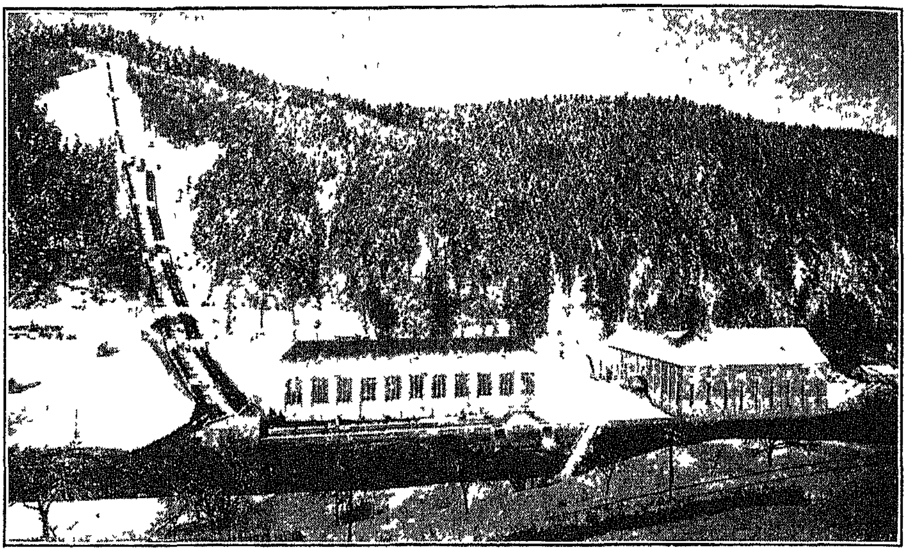
## § II — EURASIA AND THE SOUTHERN HEMISPHERE

## LUMBERING IN THE FORESTS OF WESTERN EUROPE

**Expensive Wood.** Americans visiting the populous countries of western Europe notice how careful the people are in their use of wood. Whereas the average American requires about 225 cubic feet of wood per year, the average Britisher uses only fifteen cubic feet, the average Frenchman only twenty-six, the average German only twenty-seven. Although this country has only one-fourth as many people as all Europe, it uses one and one-half times as much wood. Europeans visiting the United States or Canada are astonished at what they consider our wastefulness of wood, which to them is much more expensive than to us.

The leading countries in Europe once had rich forests covering practically all their area. As in the United

[1] Numbers and letters refer to Selected References on pages 420–424



*Courtesy of German Tourist Office*

POWER PLANT IN THE BLACK FOREST, GERMANY

FIG 215 The coniferous and hardwood forests of central Europe are valuable in many ways The rough, sandy, or swamp lands that cannot be used for crops grow a valuable timber under state supervision Protected watershed areas aid in water power development

States, large parts of these fine forests occupied land which man desired to use for other purposes and hence they were cut down. This deforestation went to such an extreme that for many years the more populous countries have had to import wood and to practice forest conservation in order to supply their necessities. Of course in Scandinavia, Finland, and in Russia there are vast forests, but even if a country uses little wood per person, it uses so much in the aggregate that it is dangerous and expensive to have to depend on foreign supplies The United Kingdom alone for its imports of sawn wood, wood pulp, and paper products spends $300,000,000 a year. This is more than the country pays for its imports of wheat and flour[1]

**Present Forests in Central Europe.** As in the United States, the coniferous forests of central Europe lie either in the sandy, rocky, or poorly drained soils or in areas too cool to be highly desirable for agricultural purposes (p. 235). In such places the conif-

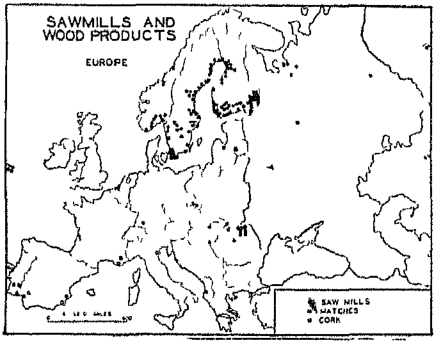
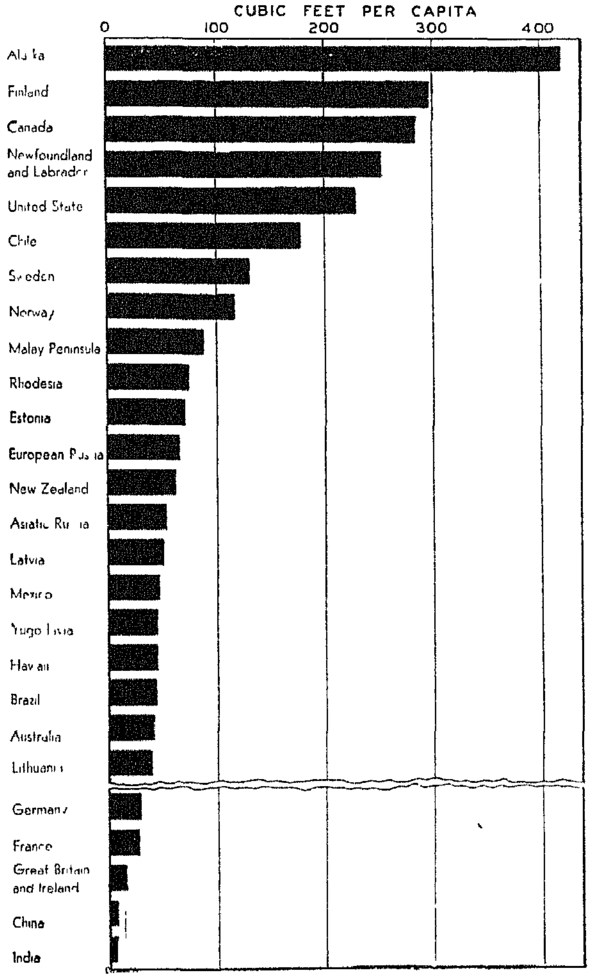


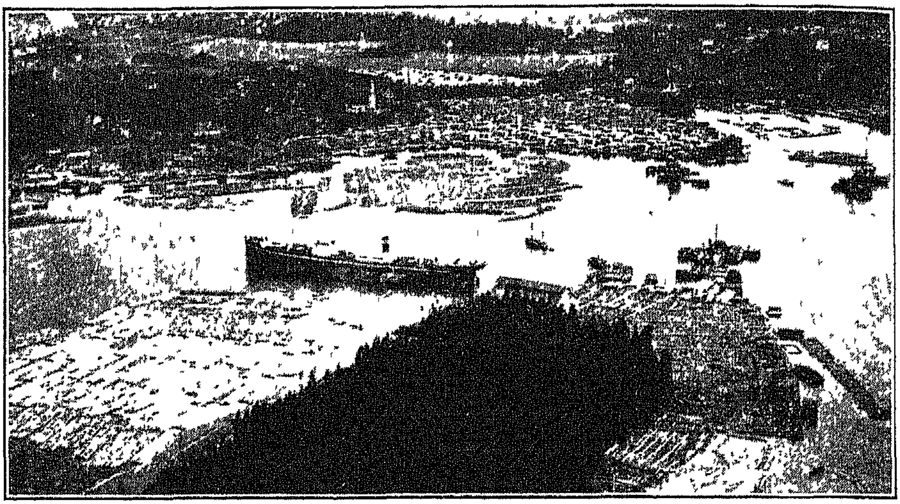

FIG 216 Most of the sawmills of Europe are in the Baltic forests. List six or more conditions that explain this What one river in Russia has an important lumbering industry? How does the timber from this valley reach western Europe? Review the conditions that favor the production of cork in the western Mediterranean.

erous forests have suffered least cutting (Fig 215) The main sections lie in the reforested Landes, in the Pyrenees, the Alps, the mountains along the middle Rhine Valley, the mountains along the southern margin of the broad northern plain of Germany and Poland, and in the poorer soils in that plain in Germany, Poland, Lithuania, Latvia, and Estonia The coniferous forests have received most attention because they grow faster than hard woods Germany, France, Belgium, Denmark, and Austria are leaders in caring for their forests.




ANNUAL PER CAPITA CONSUMPTION OF WOOD OF DIFFERENT COUNTRIES

FIG 217 Note the relation of high per capita consumption of wood to the distribution of temperate forests The group of countries below the break in the graph shows a very small use of wood by some densely populated areas. Great Britain has a smaller percentage of its land in forests than any other European country



*Courtesy of Swedish State Railways*

SAWMILL, ANGERMANALV RIVER, SWEDEN

FIG 218 This mill, established in 1740, is one of the oldest and largest in Sweden The vast yards of lumber, the huge log booms and rafts, and the large ship give an idea of the huge scale of lumbering in Sweden Logs are floated down the rivers or towed by tugs to the mill

Southward or in lower lands, the coniferous forests grade into forests of mixed conifers and deciduous trees and then into the deciduous forest (Fig. 216). The deciduous forests, because of the excellence of their soils, now occur only in patches here and there. Altogether they make a considerable area, however, outranking conifers in France, much of Bavarian Germany, southern Czechoslovakia, Hungary, Yugoslavia, Rumania, and Bulgaria

As the forests in many of these countries are so carefully supervised to prevent excessive cutting, most of the sawmills are small compared to those in our Pacific forests. Besides being small, these mills in cutting wood waste as little as possible, even refusing to use certain kinds of saws because they make too wide a cut Furthermore, the people use much wood unsawed in order to avoid the waste of squaring lumber as we do Boxes and barrels are used many times, and bonfires, such as we sometimes make out of thousands of boxes and barrels, impress the average European as a foolish waste.

**The Baltic Coniferous Forests.** In the Scandinavian peninsula and in Finland the forest situation is very different. Here the abundance of wood and wood industries is impressive. Norway uses 118 cubic feet of wood per capita, Sweden 129 cubic feet, Finland more than the United States — 299 cubic feet (Fig 217) If we should visit a port in one of these countries we should be further impressed by the tremendous amounts of wood materials — lumber, wood pulp, paper, railroad ties, matches — that figure in their foreign trade. These forest products compose by value one-third of Norway's exports, almost one-half of Sweden's, and more than four-fifths of Finland's (Fig. 218).

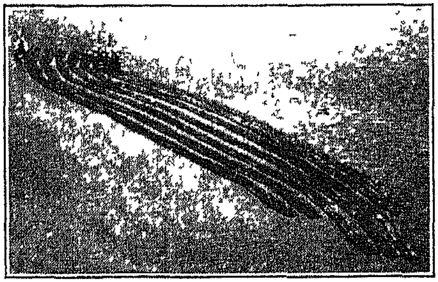
The two outstanding timbers are

pines and spruces Scattered among these coniferous soft woods are small deciduous hard woods like birch and aspen. The latter form hardwood forests of good size in southeastern Sweden and southwestern Finland Economically the conifers far outrank the hard woods, the hard woods being used locally for fuel, furniture, and tools, while the soft woods form the bulk of the production and export

The great development of lumbering in this area is due to three main factors much of the original fine forest still remains, the region lies near the huge markets of western Europe, and the people have reached a high stage of forestry. The government in Finland, for example, owns 60 per cent of the forested area While the forests are as yet being removed faster than they grow, these countries have accomplished much in the way of reforestation.

This interest in forestry results not only from the value of the trade in forest products but also from two other factors, much of this region is too cool, rocky, or swampy for good agricultural land and the protection of the forests safeguards the enormous water power resources of these countries

In contrast to the smaller mill operations in central Europe, in this region they reach enormous proportions, rivaling those on the Pacific coast. In some respects the Gulfs of Bothnia and Finland correspond to Puget Sound in regard to the number of sawmills about their margins How do these arms of the Baltic Sea and Puget Sound compare with regard to distance to important markets? On the whole the methods of logging correspond to those of our northeastern forests. The snow makes fine roads in the winter and the numerous streams facilitate bringing the logs in the spring to the sawmills at the seacoast Norway has an advantage in the long fjords which extend far inland into the forests and remain ice-free all year, whereas the Baltic Sea districts have several months of ice-closed rivers and harbors (Fig 219).



*Courtesy of Swedish State Railways*

LOG RAFT ON THE BALTIC

FIG 219 These huge log rafts are towed from northern Sweden and Finland to southern sawmills and pulp mills

**The Vast Forests of the U.S.S.R.** Russia and Siberia contain extensive forests As in other areas with a considerable north-south extent, these forests, in Russia especially, show the gradation from coniferous forests in the north to a belt of mixed forests and farther south to a deciduous forest. The deciduous and mixed forests in both Russia and Siberia have been largely cleared for agriculture, but the northern coniferous forests, extending from Finland to the Sea of Okhotsk constitute one of the great forest reserves of the world. Moreover, we may expect that these forests will last for a long time because all of the forest land is now under the control of the government and because much of the forest is so remote from markets that not until the need for wood becomes

much greater than at present will there be the incentive to cut it. Only a fraction of the annual growth is now cut. Yet the Russians have much use for wood, especially as fuel in heating houses, in factories, and on railroads But because the people are poor and cannot afford to build much or burn much, the annual consumption is about sixty-five cubic feet per person

The wood industry spreads over a huge area, but the main developments are in the west near large populations. Hundreds of villages and many large towns depend chiefly on the forests for their industries The most rapidly growing industry now belongs to the forests near the northern Dvina River, this river draining rich forests and having a good flow of water which serves to float the logs Archangel, at its mouth, is a great sawmill center and port for the lumber trade.

## THE CHINESE AND JAPANESE FORESTS

**China's Tragedy.** China is the world's most tragic example of what happens when the forests are destroyed Formerly China proper had extensive and excellent forests Now only about one-tenth of its area has forests As a result floods have repeatedly caused enormous damage, drowning thousands of people and animals, destroying crops, and carrying off fertile soil. The present forests lie chiefly in rough or remote areas in the southeast, northwest, and far west. About the edges of these forests considerable lumbering takes place, but at a distance wood is scarce As a substitute, and a very useful one, the Chinese cultivate the bamboo.

In contrast to China proper, Manchuria has forests of fine trees, especially the Manchurian pine, which frequently attain a height of two hundred feet and a diameter of five feet. Besides pine the forests contain large quantities of spruce, fir, larch, and oak, but they lie so far from the main part of China that they supply little lumber for the country Locally they supply fuel and heavy construction timber for buildings and railway ties

**Japan's Foresight.** Japan exhibits a striking contrast to China in the matter of forests Although it has a dense population one-half of the country still has forests This large proportion of forest to area is due to much rough mountain land unsuited to agriculture, to difficulties of transportation in such areas, to the necessity of protecting the small fertile river and coastal rice lands, to the need for timber for many fishing boats, and to an early policy of government forestry. In consequence Japan's forests are growing faster than they are cut, while Japan exports considerable quantities of wood to China. The most valuable soft woods are the *hinoki* and *sugi*, among hard woods the *buna*, which is Japan's most abundant tree, and *mizunara* stand out.

## THE AUSTRALASIAN FORESTS

The continent of Australia has a smaller part of its area in forest than any other continent, only 6 per cent being in forest Moreover, only half of the forest area lies in temperate lands. Not only do the forests have a small area, but the main trees do not have so much usefulness as the conifers of northern forests. The leading timbers of Australia belong to the eucalyptus family. These trees reach enormous size, the *kauri* sometimes three hundred feet with a branch-free

length of one hundred eighty feet, but the wood is hard and brittle, thus reducing its usefulness. In some small areas large trees form dense stands, recalling the productive Pacific coast forests of North America. Australia has several soft woods, but they are so scattered over inaccessible areas as to restrict lumbering. The principal producing zones for the hard woods are in eastern Australia and Tasmania.

New Zealand is much better off than Australia in forests but is cutting them so fast that the industry is threatened. Today one-quarter of the area has a forest cover. The trees include several good soft woods, the finest being the *kauri* which is one of the largest timber-producing trees in the world. Because of the fine qualities of some of the timbers large quantities are exported.

## THE SOUTH AMERICAN FORESTS

While the temperate forests of South America are rather insignificant in comparison with the vast tropical forests, nevertheless they have considerable importance. This is so because they contain several valuable soft woods and they lie near consuming centers.

On the rolling uplands of southern Brazil, northeastern Argentina, and eastern Paraguay is the splendid Paraná pine forest, the principal softwood forest of the continent. The Paraná pine, which predominates among the trees, is tall and straight with a wide flattened crown, attaining a diameter at maturity of two to seven feet and a height of one hundred feet or more. Together with *yerba maté* it makes lumbering the leading industry of southern Brazil.

Chile has the only other important temperate forests of South America. These extend from about latitude 35 degrees south to the southern tip of the continent. Especially in the northern portions, heavy rains give this area an exceptional variety of trees, including many hard woods and soft woods. While this forest region lies near the sea and has many fine timbers, much of it has been little developed, largely because the heavy rainfall makes work so difficult. The principal trees are the *roble* and the *coihue*, both beeches, the *cedro*, and the Chilean pine. Another very useful timber, which has been almost completely cut off, is the *alerce*, a magnificent tree similar to the North American redwood in size and utility.

## EXERCISES

1. (*a*) Where are the great forests of Europe today? (*b*) Why are these lands in forests? (*c*) Are the reasons for these forest lands the same as for those of North America?

2. Why have the forests in one large area of Europe largely been cleared?

3. List the factors which cause the governments of central Europe to supervise their forests so carefully.

4. (*a*) List the conditions which account for the great concentration of sawmills around the Baltic in contrast to the coast of Norway. (*b*) Answer the questions under Fig. 216.

5. List under the following headings the physical and economic conditions favoring the use of the Baltic forests in contrast to the vast forests of the U S.S.R.

*Conditions The Baltic The U.S.S.R.*

6 (*a*) Locate the forest areas of China. (*b*) List the conditions that favor the growth of the Manchurian forests (*c*) Why don't these forests supply more wood and lumber to China?

7 (*a*) List the conditions that cause the Japanese to have an important forest industry and to take good care of their forests (*b*) Is most of the land of Japan in farms or in forest or woodlands (pp 32 and 158)?

8 List the conditions that account for Australia having the smallest forest industry of any continent

9 (*a*) Why are the temperate forests of South America relatively so valuable? (*b*) From the maps list the physical conditions that favor the growth of the fine forests of Chile.

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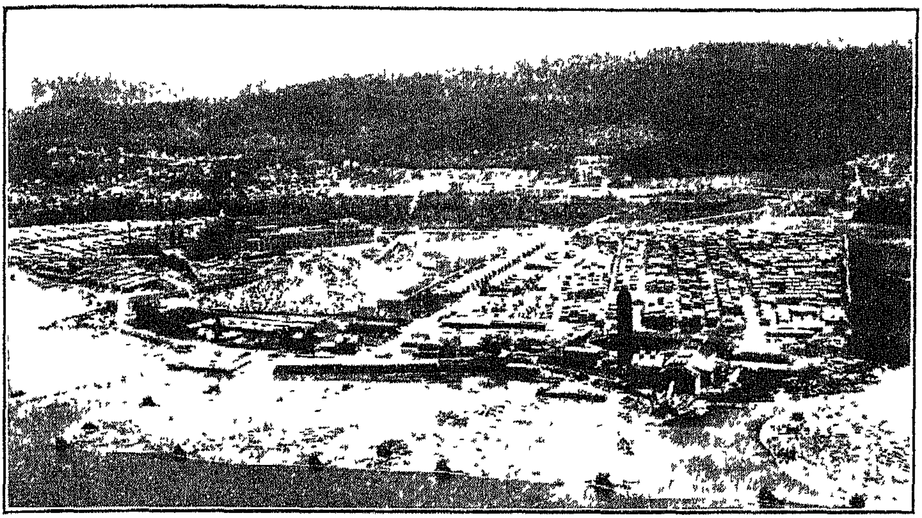
[2] Numbers and letters refer to Selected References on pages 420–424.



*Photograph by Royal Canadian Air Force*

LUMBER AND PULP MILL, ATHOL, NEW BRUNSWICK

FIG 220 The huge lumber mill and yards are shown on the right, the pulp mill and piles of pulpwood on the left, the log boom and logs in the foreground Sufficient logs must be floated down the river and held to keep the mills in operation during the winter when the river is frozen. In summer the pulp mill stores up huge piles of pulp wood The great pulp mills lie near the forests

## CHAPTER XXIII

# WOOD PULP AND PAPER

**Paper and Wood.** Less than one hundred years ago all paper was made from cotton and linen rags, hemp, and a few other grassy fibers. But today nine-tenths of the enormous amount of paper used in newspapers, books, writing paper, wrapping paper, boxes, and in a myriad of other ways is made from wood fiber (Fig. 220). This change to wood fiber has given the world two very significant benefits. It has made paper much cheaper and it has led to more intense interest in forest conservation, because the big enterprises required to convert wood into fiber need a steady supply of wood.

The basis of all paper is cellulose, an inorganic substance which serves to support all plants. Therefore, theoretically, any plant may be used for paper making. Only a few, however, make a desirable quality of paper or are available in large enough quantities for a good-sized industry. The idea of using wood for paper was commercially successful first in 1854 and since that time the world's consumption of paper has grown many fold. Try to imagine how different the world today would seem without paper. In the United States, although the population has doubled since 1890, the consumption of paper has increased more than twelve times. For every person in the United States there is an an-

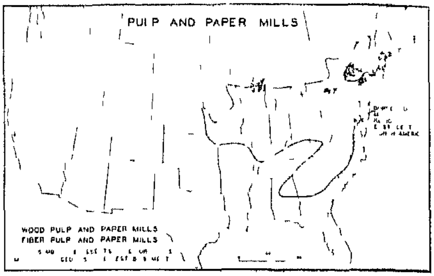
nual consumption of more than two hundred pounds of paper Because of proximity to great resources of wood, this country and Canada lead the world in paper consumption Northwestern Europe also ranks high But the enormous forest-poor population of the Far East consumes much less and the people still depend largely on paper made of rice straw, the paper mulberry tree, bamboo, and rags

**Manufacture of Pulp.** There are two principal methods of converting wood into pulp — the mechanical and the chemical The mechanical method is the older but is now less used and is principally employed in making cheap paper for newspapers After being cleaned of bark and dirt, the logs are cut into small chips which are ground into pulp and mixed with water Then large rollers mat and dry the wet pulp into paper In this method only woods having a strong fiber will stand the grinding, and the wood must be clean as the gums and tannins are not removed Moreover, the final paper is weak. In contrast, the chemical process produces practically pure cellulose and the paper comes out clean and strong Hence it is used ordinarily in manufacturing book and writing paper. For writing paper and some book papers an additional stage in manufacture makes the surface smooth by filling the small spaces between fibers with "sizing" materials such as clay, rosin, alum, and talc.

## THE WOOD PULP AND PAPER INDUSTRIES OF NORTH AMERICA

**The Wood Pulp Industry.** While many districts manufacture both wood pulp and paper, we may distinguish between a wood pulp industry and a paper industry

The greatest wood pulp region in the world lies in the area which includes the Great Lakes States, the North Atlantic States, and southeastern Canada (Fig 221). As is the case



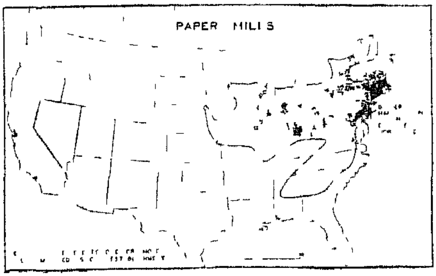

Wood Pulp-paper Mills, United States and Canada

Fig 221 A wood pulp-paper mill is one that makes wood pulp and converts it into paper or makes only wood pulp In what forest regions are most of the pulp mills located? Explain why pulp mills dominate in northern New England Compare with Fig 222 The pulp industry, using spruce and hemlock for cheap paper, is increasing rapidly in the Pacific forests

in the world's second greatest region, the Scandinavian peninsula and Finland, the manufacture of wood pulp is carried on nearer the forest regions than the consuming markets. Yet both regions lie near dense populations As paper is a cheap commodity, transportation costs must be as small as possible. Hence, the first consideration in locating a pulp mill is to have it near a continuous supply of logs, and the second consideration is to have it near the paper mills which in turn lie near or in centers of population. Besides these factors of location relative to transportation costs, the pulp mill, which represents a huge sum of money, must lie near forests of suitable trees, and large enough to furnish raw material for many years. Although much of the forest may now contain only small second-growth trees, this does not

greatly hamper the pulp industry, for it uses every scrap of wood

The chief tree in the wood pulp industry is the spruce, which furnishes three-fifths of the pulpwood used in




Paper Mills, United States and Canada

Fig 222 A paper mill makes only paper from wood pulp or other materials which it buys The manufacturing region of east central North America has more than 90 per cent of the paper mills of the United States and Canada Explain why paper mills dominate in southern New England

the United States. It lends itself especially to paper making because its wood contains long, strong, and soft fibers, has large quantities of cellulose easily separated from other substances, has a low percentage of other substances, has a white fiber, and is about the best wood to stand the mechanical process of pulping Next to spruce, but only about one-fourth as important, ranks hemlock While hemlock has short and weak fibers, it is cheap because it does not make good lumber; besides, a chemical process makes the fibers more serviceable For some better grades of paper, a small amount of "soft" hard wood is used, mainly the aspen

**The Need for Water and Power.** The problem of water has much influence in locating the pulp mill. The mill must have great quantities of clear pure water to wash the fiber and to carry the pulp through the plant. Do you think a region like the Adirondack Mountains would be satisfactory in this respect? The need for water to develop power is important also The mills generally lie at some

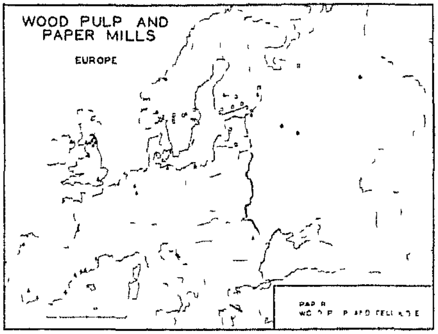
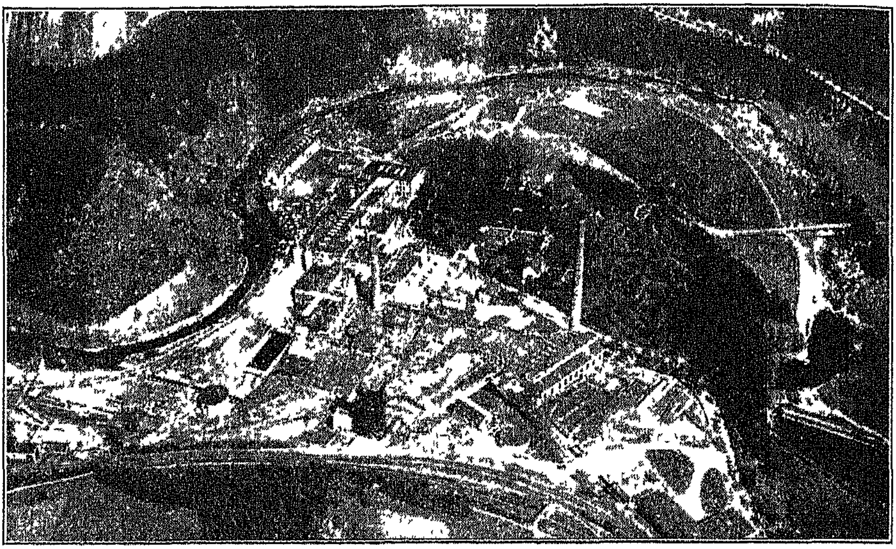



Fig 223 Point out four areas of paper mills in Europe Nearly all the pulp mills are in the Baltic forests Why are more paper mills located in west central Europe than north of the Baltic?

distance from industrial centers, so that shipping coal would add much expense Hence, wherever possible the pulp mills avail themselves of hydroelectric power. Study relief and rainfall maps of North America and decide whether the pulp and paper region has large resources of such power

**Commerce in Pulp Products.** Cheaper paper, like that used for newspapers, is generally made in the neighborhood of the pulp mills This is so because such paper requires little treatment to be prepared for the printing press As the Canadian forests are the more remote and less developed, they lead in the output of mechanically made newsprint, two-thirds of which goes to the United States For better paper and to supply distant paper mills which have used up nearby forests, the remoter areas also ship enormous quantities of the wood pulp Canada exports almost a million tons of wood pulp a year.



*Courtesy of Photogrammetric*

AIRPLANE VIEW OF LARGE PAPER MILL IN SOUTH GERMANY

FIG 224 This mill makes several grades of paper — newsprint, wrapping, and writing. What relation do the railways, the rivers, and the forests have to the paper industry? Why should Europe have a more scattered paper industry than the United States?

**Manufacturing Higher-Grade Papers.** Like pulp mills, paper mills making higher grades of paper require abundant pure water and power. But besides they need many raw materials and skilled labor (Fig 222). Therefore they lie nearer centers of population, generally in places where there used to be a pulp industry. Thus in North America we find a concentration of writing and book-paper mills in the Connecticut Valley, where the industry was started a long time ago and has good water, much water power, and relatively easy access to coal supplies

## THE WOOD PULP AND PAPER INDUSTRIES OF EUROPE

**The European Wood Pulp Industry.** Although it does not equal the North American industry in size, Europe's wood pulp industry not only has more favorable natural conditions, but as a whole is better managed, reaching its greatest development in the Scandinavian peninsula and Finland (Fig 223). The region enjoys especially such access to the ocean that it produces pulp at a cost low enough to permit it to export a million tons of wood pulp across the sea to the United States and twice as much to the nearby European countries As we have seen in the discussion of lumbering in this region, the forests furnish a constant supply of pulp logs, and the rugged topography facilitates water power development

**The European Paper Industry.** As in North America, the wood pulp regions also produce huge amounts of newsprint. As Europe has many more centers of population and therefore a more scattered paper industry, the exports of pulp greatly exceed news-

print (Fig. 224) The nearness of the paper mills to the pulp regions as well as the markets accounts for this Most striking is the case of England, which has no pulp resources of its own, yet ranks high among paper manufacturers because of its dense and advanced population (p 260).

## EXERCISES

1. (*a*) Outline briefly the history of paper manufacturing (*b*) Make a list of uses of paper today

2. Contrast the two processes of pulp manufacture.

3 (*a*) Answer the questions under Fig. 221. (*b*) List six or more reasons to explain why nearly all the pulp mills of North America lie near the Great Lakes and the St Lawrence River.

4 Why does spruce rank first as a source of pulp?

5 List seven or more physical and economic conditions to explain why the manufacturing region of east central North America has more than 90 per cent of the paper mills.

6. Explain the great concentration of paper mills along the Atlantic seaboard from Portland to Baltimore

7. What are the chief differences between newsprint and writing papers?

8 Write to the American Writing Paper Company, Holyoke, Massachusetts, asking for pictures, pamphlets, and other information on the paper industry, use this material for a report on the process of making high-grade papers If you are near a paper or pulp mill, arrange to visit the mill to see the process After the visit write an essay on the process

9. Visit the press of a newspaper, obtain the sources of the materials and see how the paper is printed, then write an essay on " Our Daily Newspaper."

10. Explain fully why the European pulp industry is concentrated in the Baltic forests. Why are the European paper mills more scattered than those of the United States?

11. Show why England is almost completely dependent upon other countries for her daily news.

## SUBJECT FOR A DEBATE

Resolved That northeastern United States should maintain a permanent pulpwood stand to meet our requirements.

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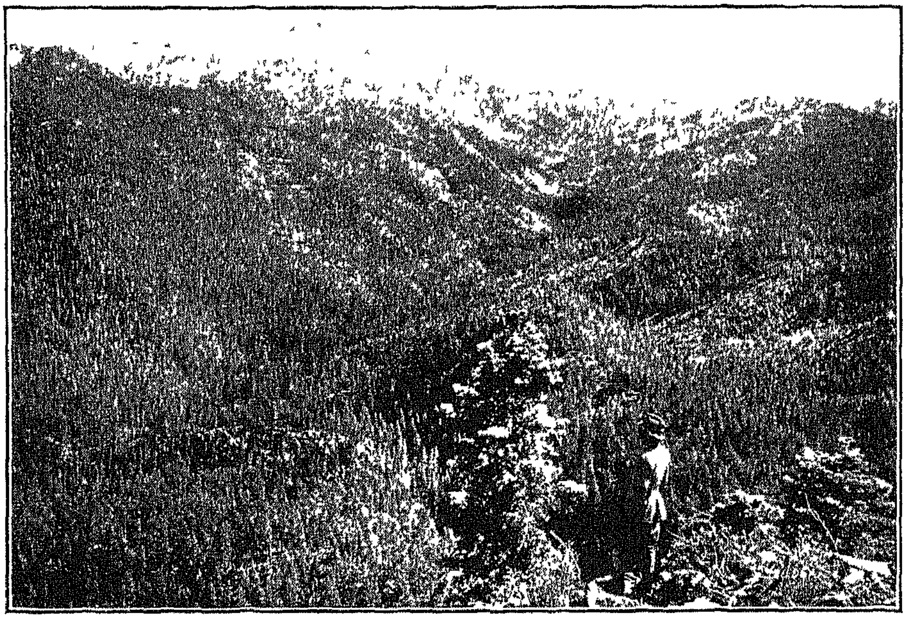


*Courtesy of United States Forest Service*

THE SANTA FÉ NATIONAL FOREST

FIG. 225. In many rugged areas the wisest use of forest-clad hills is as water-shed areas. This is especially true in many parts of the Appalachian, Rocky, Sierra Nevada, and Cascade Mountains. More of our forest areas should be in national forests. Compare with Fig. 215

## CHAPTER XXIV

# FOREST CONSERVATION

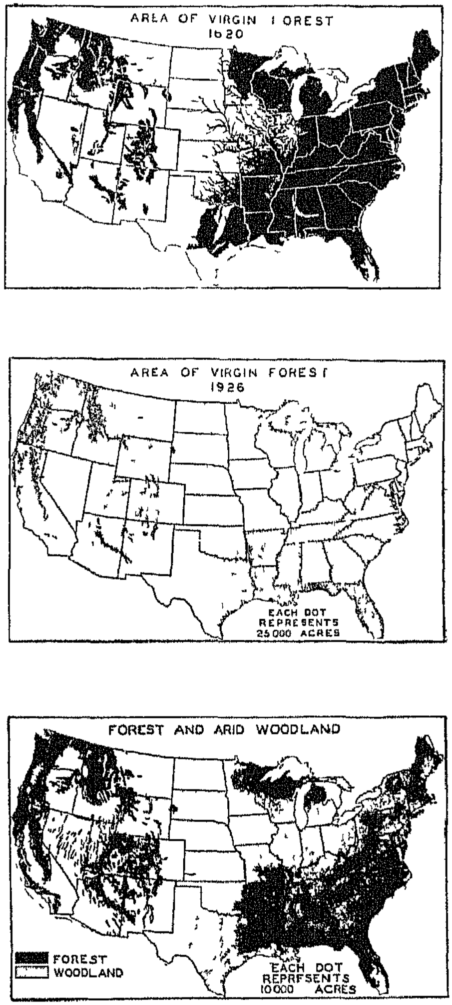
**"Mining" Timber.** When men have great forest resources, they generally mismanage them. In many regions where forests should be growing today there are none, because the people recklessly "mined" the timber, that is, they went on cutting without replacing; and as in a mine, where the miners work until the mine is exhausted, the forests were destroyed. With a mine there is no other way, but with forests, man can perpetuate a valuable resource. When the forests go, man finds himself forced to consider the problem of retaining some forested land, not only for the timber but also for protection against floods and soil wash. History offers several outstanding examples of the disastrous results of destroying valuable forests.

**China.** In many parts of China straw is carefully saved to be used for fuel. Wood is really a luxury. Yet China once had fine forests. The growth of the great population and its need for crop land caused the people to remove vast areas of

forest. Not only did this result in a scarcity of wood, but it contributed to disastrous floods which frequently kill thousands of Chinese While forests do not do away with floods, they do prevent many of them and lessen the evil consequences of the more serious ones (Fig 225) The trees themselves, their widespread roots, and the humus of the forest floor act as giant sponges, so that when rain falls it runs slowly down the steep land Where no forests exist on the slopes, especially when the soil has become water-soaked, the rain rushes rapidly into the valleys, swelling the rivers until they overflow their banks Besides the inundation, this action washes away the soil from the hillsides and in many cases brings down sand and stones onto the valley farmlands, thus inflicting damage in two more ways. Thousands of square miles in China have suffered in this manner.

**The Mediterranean Region.** Much of the Mediterranean region also shows the harmful effects of removing the forests in rough country. In ancient days, broad areas, which today are practically desert, supported flourishing farms and cities. But the destruction of forests caused floods to wash away soil in some parts and in others to deposit worthless sands and gravels Perhaps worse, these floods in some places created marshes where once had been fertile land

**The United States.** The United States probably will not allow deforestation to cause so much damage as in the cases mentioned (Fig 226) Although the movement to preserve the forests has so far made little progress in comparison with the huge area of the country, we may expect great improvement as time goes on. But at present the American forests are losing four times as much timber per

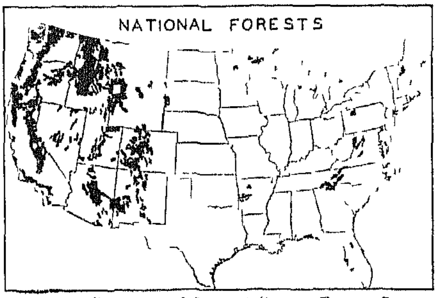



*Courtesy of United States Forest Service*

OUR VIRGIN FORESTS IN 1620 AND 1926, AND OUR FOREST AND ARID WOODLAND

FIG 226. Point out four areas that show a great decrease in our virgin forests. Why have most of the hardwood forests (those from New York to Illinois) disappeared? Which of the areas where most of the virgin forest has been cut still have great forest resources?

year as they grow.[1] Obviously this cannot continue too long without destroying our forests In some sections, especially the warm rainy southeast, floods and soil destruction cause appalling damage Although the agitation for forest protection began many years ago, not until 1905 did we establish a definite forest policy, when the government designated the first National Forest (Fig 227) Now the government controls more than two hundred thousand square miles of such lands, these and state forests account for about three-tenths of our remaining saw timber But to meet the future needs of this country we must plant great areas that are now barren, ugly, cut-over lands, unfit for agriculture, and we must manage them as carefully as the Europeans manage their forests In other words, we must stop "mining" our forests and grow them (Fig. 228). It is estimated that if we adopt forestry as intensive as that now used in Scandinavia, Germany, and France, the 470,000,000 acres of forest land left can produce all the timber that we use at present and a safety reserve of one-fifth extra.




*Courtesy of United States Forest Service*

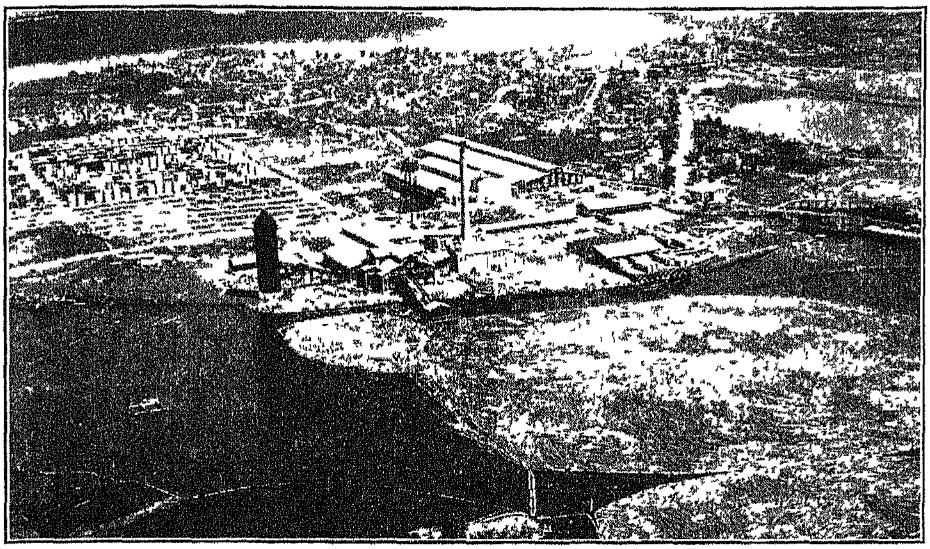
FIG 227 The national forests and state forests have about three-tenths of our remaining timber Explain the distribution of the national forests Compare with the preceding figure

**The Conservation of Forests.** A good forest policy embraces several distinct principles For the United States, as with western Europe, it must include not only conservation of the present forests, but also what is called "afforestation" or planting of forests. To manage our forest resources properly under a system of good forestry, as a country and as individuals, we must observe certain practices. In cutting the forests, only the mature trees should be used and they should be felled so that they do not damage other trees when falling This method would be very expensive in the Pacific forests with rough land and huge trees and where a small outfit costs $100,000, gathering the logs would necessarily destroy many small trees As a precaution against fire, all the branches should be cleared In some places where forests might grow, grazing animals continually nibble off the young trees, thus destroying a

[1] Each person in the world uses, on the average, about thirty-two cubic feet of wood each year. Nearly half the wood cut is saw timber, most of the remainder is firewood The following table shows the rank of the different continents in their use of wood

| *Continent* | *Total million cu ft.* | *Per Capita cu. ft* | *Saw Timber million cu ft* | *Firewood million cu ft* | *Per Cent Saw Timber* |
|---|---|---|---|---|---|
| North America | 27,192 | 188 | 14,372 | 12,820 | 52 8 |
| Europe | 16,641 | 35.8 | 8,844 | 7,797 | 53 1 |
| Asia | 7,917 | 9.1 | 1,539 | 6,378 | 19 4 |
| South America | 2,527 | 39.2 | 294 | 2,233 | 11 6 |
| Africa | 774 | 5.7 | 114 | 660 | 14 7 |
| Australia and Oceania | 297 | 36.1 | 114 | 183 | 38 6 |
| Total | 55,348 | 32 2 | 25,277 | 30,071 | 45 6 |

Zon and Sparhawk: Forest Resources of the World, p. 49



*Photographed by the Royal Canadian Air Force*

A HUGE LUMBER MILL, ONTARIO, CANADA

FIG. 228 The great forests and huge lumber mills of Canada supply an increasing proportion of our consumption of forest products

potential forest. At sawmills in this country, far too much wood is wasted, the owners of some mills even having boasted of how much wood they burn every year. Since the development of the wood pulp industry this destructive practice has diminished, but in many districts there are no nearby pulp factories We as individuals also have wasteful habits with regard to wood. Even though we do not at present feel the need of being careful in our use of wood, we shall in time as prices rise. Other factors to keep in mind as arguing for the protection of forests is their beauty and the opportunities for recreation in them, and their value in storing water and regulating the flow of streams used for power (Fig 229). As more of our coal is used, this value of forests will become increasingly important

## EXERCISES

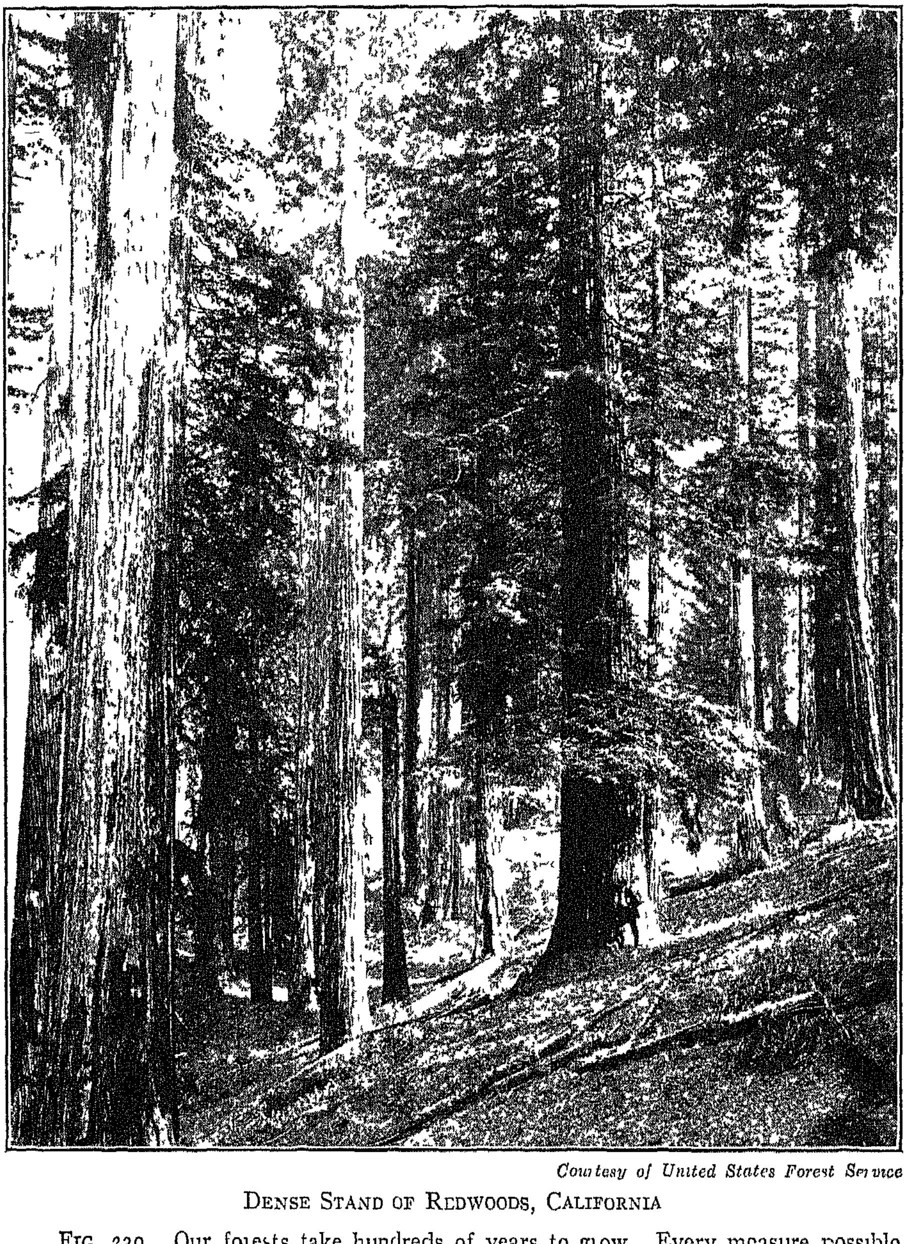
1. (*a*) Study the conditions in China shown on the following maps. pp. 4–5, 10–11, and 235. (*b*) Compare those in the eastern United States on the same maps. (*c*) What is meant by "China's Tragedy," p. 264? (*d*) Make a complete list of the losses to China from deforestation.

2. From the table p. 274 answer the following questions: (*a*) What percentage of the world's wood does North America and Europe cut? (*b*) What percentage of the saw timber? (*c*) What percentage of the firewood? (*d*) Why does Australia have the smallest forest industry? (*e*) Can this great use of wood continue, if forestry is not practiced on a large scale?

3. List several reasons to show that our national forests are a valuable asset.

4 Outline fully the principles of a good forest policy of the United States.

5 State in outline form several reasons why it is necessary to keep the water-shed areas of the Appalachian Mountains forested



*Courtesy of United States Forest Service*

DENSE STAND OF REDWOODS, CALIFORNIA

FIG 229 Our forests take hundreds of years to grow Every measure possible should be taken to use them wisely

## TWO EXTRA LESSONS

1 By writing to the state forestry departments of a state in the west and one in the east, prepare for and hold a conference on the forest policy of the two sections of the country, emphasizing the forest policy and the values to be gained by each.

2 Make a study of the work of the

reforestation program of the present national administration Write to the Forest Service, National Park Service, and the Department of Agriculture, Washington, D C, for information, **J**, XXIV (1934) 129–133

## A SUBJECT FOR DEBATE

Resolved. That most farmers in the eastern half of the country should have some woodland

Use accompanying references and "Wood for the Nation," **106**, (1920), pp 147–158

## READINGS[1]

"Problems of Forest Planting in the Northeast" — **M**, XXX (1932), 162–168.
"Timber Mining" — **106** (1922), pp 84–89.
"Forests and Land Use Problems" — **106** (1922), pp. 89–108
"Timber Supply Problem" — **106** (1922), pp. 108–123
"Forest Destruction by Fires" — **92**, pp 253–258
"The Use of Waste Wood" — **106** (1920), pp 439–462
"The Fight Against Forest Fires" — **C**, XXIII (1912), 662–684
"Exploded Wood" — Write to Gallher Brothers, Biltmore, North Carolina, for booklet

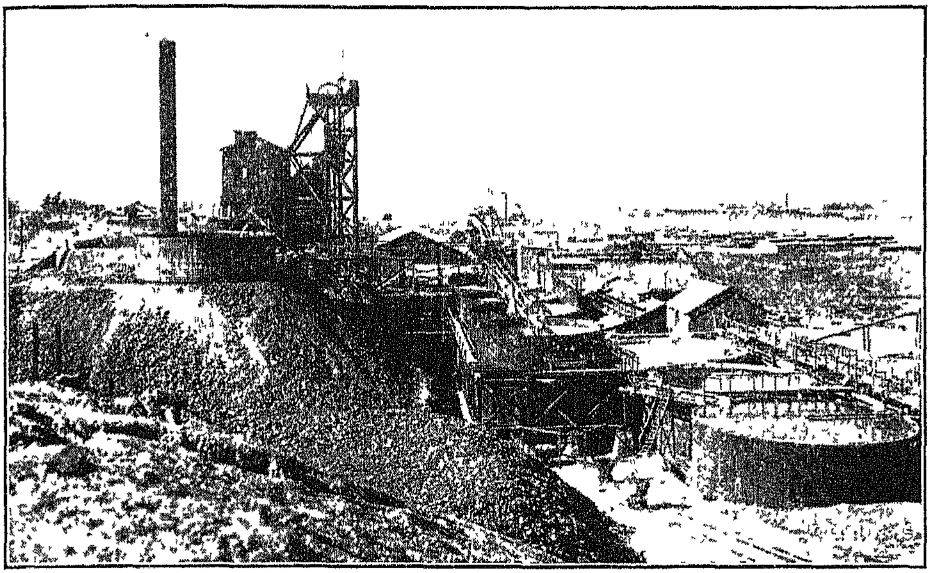
## TOPICS FOR INVESTIGATION AND REPORT

"The Forest Policy of the United States" — **23**, pp 473–478, **106** (1922), pp 161–172; **J**, XXIV (1934), 129–133.
"Destruction of Forest Lands by Pests" — **106** (1922), pp. 162–166, maps; **92**, pp 259–265
"Economic Consequences of Forest Depletion" — **92**, pp. 271–282
"Measures to Prevent Forest Destruction and Waste" — **92**, pp 282–295.
"Forests and the Protection of Soil Erosion and Floods" — **M**, XXX (1932), 328–335
"Woodlands and Farm Management" — Professional Paper, No. 863, United States Department of Agriculture, Washington, D C, 1920
"The Muscle Shoals Project" — *The Commonwealth*, XVIII (June 2, 1933), 126–128.
"A Forest Tragedy — The Rise and Fall of a Lumber Town" — Bulletin, United States Department of Agriculture
"The Place of the Eastern National Forests in National Economy" — **J**, XIII (1923), 532–539
"Saving the Redwoods" — **C**, XXXVII (1920), 519–536
"Problems of Reforestation in Puerto Rico" — **A**, V (1929), 369–381.

[1] Numbers and letters refer to Selected References on pages 420–424.

# PART VI

# MINING INDUSTRIES



*Courtesy of South African Railways and Harbours*

A MODERN GOLD MINE, TRANSVAAL, AFRICA

FIG. 230. This mining region is typical of not only gold mines but of many mines throughout the world. Is it a region of sparse or dense population? Of heavy or light rainfall?

# CHAPTER XXV

## THE NATURE AND DISTRIBUTION OF MINING

**The Stone Age.** The earliest men known to science developed what we know as the Stone Age. We have all seen pictures of the supposed appearance of these men on the hunt or at work. If on the hunt, the man would have a huge wooden club or a stone hammer made by attaching a handle to a boulder. If at work, he would have a stone hammer or a few implements of bone; for cutting he would use pieces of flint or other hard substances. The use of these simple tools meant a big step forward for man. But imagine what difficulty you would have in making a box if you had instead of neatly sawed wood, steel hammer, and steel nails only some branches, a stone or two, and thongs of leather or vines from the forest. So long as man depended upon such tools he could not develop complex activities (Fig. 230)

**The Early Metal Ages.** When man discovered how to make tools out of metals he advanced another great step. But it took him many centuries to learn how to use the most useful metals. When man discovered how to make much use of copper, the Copper Age began. Copper by itself could not greatly aid man for this metal is naturally rather soft. Something was needed to harden the copper and men

to utilize its great qualities of strength, hardness, capacity for being made into many forms, durability, and, in connection with electrical industries, magnetic properties

**Other Minerals.** Copper and iron figure in history because they have constituted the bases of certain distinctive periods, but many other minerals have also had a long though less significant history Among metals gold, silver, lead, and zinc had an early start Among non-metallic minerals the use of salt is as old as the history of man, and many others have long been known. But the great fuels, coal and petroleum, were utilized only recently. These mainstays of modern industry played practically no part in the ancient history of the Mediterranean region. Until their use became widely known man depended for power on his own muscles, on animals, wind, or falling water (Fig 231). Fuels like coal and petroleum led to the development of man's wonderful servants, such as the locomotive, steamship, automobile, and airplane. Our modern civilization depends upon many minerals from all parts of the world.

**The Distribution of Minerals.** The way in which minerals are distributed over the earth shows little regularity as such resources as fish or forests This is true largely because the distribution of minerals has little to do with the present-day climate. Instead it depends upon ancient climates and geological processes. Nevertheless we are able to pick out several relationships (Fig. 232).

The most conspicuous fact in the distribution of minerals is that they are most abundant in mountainous regions. Three main causes are responsible In the first place, mountainous regions have or have had subterranean volcanic activity, the primary concentration of minerals being due to bodies of molten rock Second, the bending and breaking of rock strata in mountainous regions has uncovered valuable mineralized zones Third, the rapid erosion characteristic of mountains has in many cases removed thousands of feet of materials and exposed valuable minerals.

The relationship of mountains and minerals is more true in the case of metals than of non-metals. Great areas of coal and lignite underlie plains as well as mountains But petroleum occurs almost entirely in places where the rocks have not suffered much change since the petroleum was formed If the rocks underwent much bending or breaking, the fluid petroleum and natural gas would escape.

**The Nature of Modern Mining.** The fact that minerals so often abound in mountains in part explains the stupendous mines of the modern world. In many cases, rich deposits are found hundreds of miles from centers of manufacturing so that in order to make mining pay the owners must provide transportation facilities on a huge scale and must build towns before they can use the expensive equipment of the mine itself. Whether in mountains or plains, large-scale operations characterize modern mining. Minerals have become indispensable in our life. The world requires such quantities that enormous enterprises are essential.

Modern mining is closely related to manufacturing, in fact mining depends upon manufacturing. There is much manufacturing in mining itself

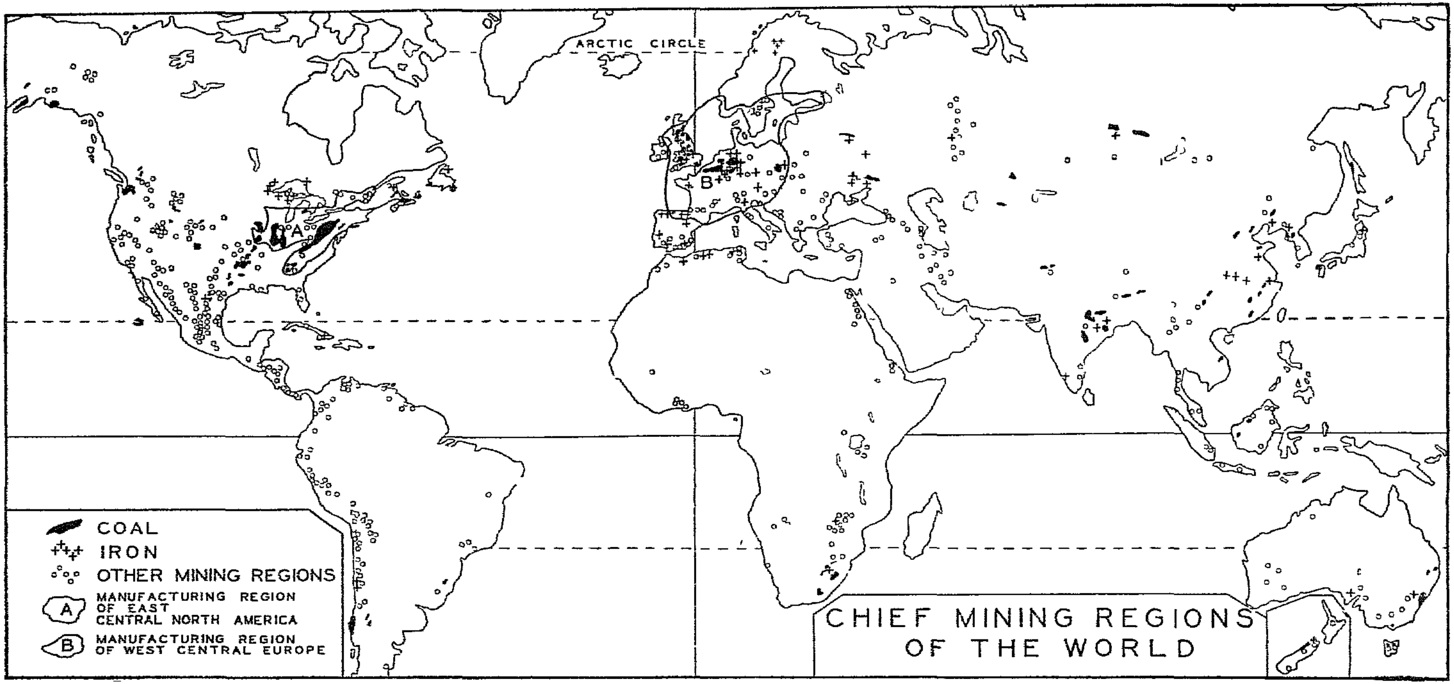



FIG. 232. 1, Coal mining regions 2, Iron mining regions 3 Regions mining other products A manufacturing region of east central North America, B manufacturing region of west central Europe

Compare the mining regions of the world with the relief map (pages 10–11) Are there more mining regions in mountains or in plains? What important minerals are found chiefly in plains? What relation exists between the principal coal mining areas of the world and population density (pages 4–5)? Other mining regions and population density? Note areas A and B These are the two principal manufacturing regions of the world They produce nearly nine-tenths of the world's coal 90 per cent of the world's pig iron, and 92 per cent of the world's steel They mine a very small part of the world's output of nearly all other minerals, but they use most of the minerals produced in distant regions Why are they able to do this? In answering this question refer to pages 24 337 402 and 4–5 What two large countries in South America produce almost no minerals? Which countries in South America have many mining regions?

because minerals are seldom ready for use when brought from the ground Mining companies often take the first steps in the preparation of the minerals — crushing, washing, grading, concentrating, smelting, and casting Some manufacturing concerns mine their own raw materials such as clay, limestone, coal, and iron. This emphasizes in a striking manner the importance of mining to the modern world

## EXERCISES

1 (*a*) In what way have minerals played a big part in the development of civilizations? (*b*) Why did the people of England for thousands of years fail to develop the iron and coal resources?

2 (*a*) What are the special qualities of steel? (*b*) Study Fig 231, answer the questions under the figure (*c*) Answer the questions under Fig. 232

3 Make a list of minerals that are important in producing the machines and materials of our civilization

## A SPECIAL PROJECT TO BE USED WITH THIS CHAPTER

Assign one student each to report on (1) water power, (2) coal, and (3) oil, in " A World of Power," A, I (1925), 133–142

## READINGS[1]

" A World of Power " — **A**, I (1925), 133–142.
" The History of the Use of Iron " — **8**, Chapter XVI
" Ancient Civilizations of England " — **L**, II (September, 1932), 1–6
" Why Minerals are Most Abundant in Mountains " — **16**, pp. 197–198
" Mountain Mining Camps " — **1**, pp. 162–170

## TOPICS FOR INVESTIGATION AND REPORT

" Stages of the Mining Industries " — **16**, pp 198–202, **77**, pp 44–57
" Sources of our Alloy Minerals " — **82**, Chapter III.
" Mining in the Andes " — **85**, Chapter XI, **7**, II, Chapter XVI.
" Our Minerals are Exhaustible " — **92**, pp 17–22, 28, 50, 96–98
" Characteristics of Modern Mining " — **77**, pp 51–57, **15**, pp 110–115.

[1] Numbers and letters refer to Selected References on pages 420 424

*Courtesy of Canadian Pacific Railway*

SCALING THE SUMMIT OF CHILKOOT PASS

FIG 233. In the great rush of 1898 to the Yukon gold fields thousands of men perished Read the story of "The Gold Rush to the Yukon"

## CHAPTER XXVI

# MINING PRECIOUS METALS AND STONES

**The "Forty-niners."** Who has not thrilled at the story of the "Forty-niners"? History contains several dramatic episodes like the gold rush of 1848–1849 (Fig 233). In 1845 San Francisco was a little town of a few hundred souls, interested largely in the cattle ranches of California. In 1848, gold was discovered at the American River and soon the whole world knew about San Francisco. Thousands of people endured terrible sufferings to reach California, some going around Cape Horn, some across the Isthmus of Panama, others across Mexico, and the most famous movement braving the thousands of miles across the North American continent. In a year San Francisco had fifteen thousand people from all over the world and many thousands more were in nearby places or on their way. All for gold!

**Precious Gold.** A beautiful metal and besides easily made into jewelry and other ornaments, gold has had a powerful influence on the history of the world for thousands of years. It encouraged art, led to great discoveries, and for centuries has constituted the supreme standard of value in commerce Today gold is the basis of an important mining industry.

**The United States' Gold Industry.**

The history of western United States is closely tied up with the gold mining industry The California gold rush was one of many important discoveries that led to the early exploration and settlement of lands which otherwise might have remained unused for many years. In many districts the land was so barren that the mining towns lasted only as long as the gold, the west contains a number of such "ghost" towns where the exhaustion of a mining district has caused people to abandon entire settlements having fine buildings and streets Sometimes these were resettled, either when new discoveries occurred nearby or when improved machinery allowed the use of low-grade ore.

Several states have experienced the ups and downs of gold mining California, although surpassed at various times by Colorado or Nevada, shows the steadiest production and still leads. More recently Utah and South Dakota have become prominent gold states (Fig. 234). For the entire

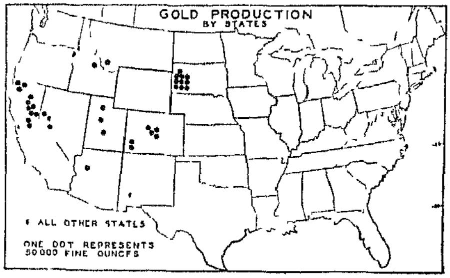



FIG 234 What two states produce half of our gold? What part do the leading five states produce? New Mexico has one-half of a dot, how much does that equal? What are some of the problems of mining in these regions?

country production has shown a rapid decline since 1915, the output now being less than half that of 1915. Despite this drop the country has many gold mining regions (Fig 235).

**How Gold is Mined.** In this country two chief methods are used in mining gold. placer and tunnel mining. Placer mining, which depends upon the fact that particles of gold occur in sand and gravel of stream beds, has four types The simplest may be practiced by the picturesque pros-

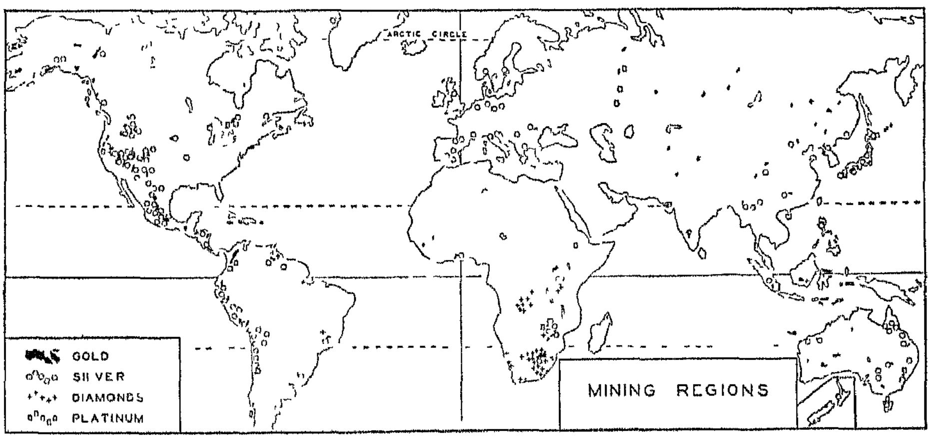
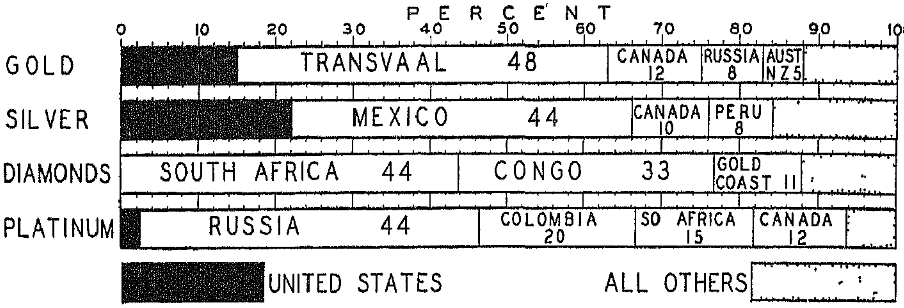



FIG 235. Many regions in the world mine gold, silver, diamonds, and platinum Are the mines chiefly in mountains or plains? Are they chiefly in regions of sparse or dense population? Of few or many railway lines (pages 404–405)? Of heavy or light rainfall? Of regions of coal production? Of regions of manufacturing (page 337)? From your answers to these questions, make out a list of the chief problems in mining in these precious products.




PERCENTAGE OF OUTPUT BY COUNTRIES OF GOLD, SILVER, DIAMONDS, AND PLATINUM

FIG 236 Which country is the chief producer of each product? How does the United States rank? The United States produces no diamonds and almost no platinum, but we use a great deal of each In a recent year the world production of gold was worth $460,000,000, the amount of silver was 192,000,000 fine ounces, of diamonds 7,000,000 metric carats, of platinum 192 000 troy ounces

pector who has for equipment only a pick, shovel, a miner's pan — somewhat like a wash basin — a burro, and some food and clothing. Into the pan the miner scoops some of the gold-bearing gravel with a quantity of water Then he shakes the pan, allowing the sand gradually to drop out. If gold is present, being heavier, it remains in the bottom of the pan A second method differs from this in that the miner or miners set up a long trough with crevices in the bottom In this the gravel is washed by a stream of water and the gold settles into the crevices. More expensive than this is hydraulic mining in which a powerful stream of water washes whole banks of gravel into the sluices. The fourth type is dredging, in which a dredge digs up the gravels in front of it, washes them, and drops them in containers. These four kinds of placer mining are more common in new gold regions. In the United States, now, only one-fifth of our gold is mined by placer methods. The second method consists of mining, by means of shafts and tunnels, the gold ores from veins or buried gravels within the earth Formerly the ore would be ground fine and then washed as in placer mining, but for this only rich ores would do Late in the nineteenth century came a great improvement, by which cyanide of potassium dissolved gold out of the ore and made possible the use of low-grade deposits that in earlier years could not have been used

**South African Gold.** At present half of the world's gold comes from South Africa In the Transvaal, in a range of low hills known as the Witewatersrand, or the Rand, lies the greatest gold deposit known Johannesburg, a modern city of three hundred thousand people, lies in the center of the region and depends upon the mines Fifty years ago there was no settlement there and the site lay three hundred miles from the railroad To-day it is the largest city in South Africa.

Study Fig 230. In the foreground are the hoist, crusher, and the plant using the cyanide process. The ore comes from nearly a mile below the surface. Notice the huge piles of refuse in the distance Handling an enormous amount of low-grade ore is typical of numerous mining regions The huge machines come from distant

regions, the workers and engineers from various lands, chemicals, clothing, food, and other supplies are brought in from many places The gold moves chiefly to outside areas Why is water a problem here?

**Other Gold Mines.** Every continent at one time or another has experienced the feverish excitement caused by gold discoveries. Gold led the early Spaniards in South America and Mexico Australia had a great rush shortly after the California gold rush and had other later discoveries Siberia has had many discoveries and some claim that it contains the world's greatest gold fields At present, after the Transvaal and the United States, the leading producers are Canada, Russia, Australia, Mexico, and Rhodesia (Fig 236)

**North America's Leadership in Silver.** North America, for a long time the leading producer of gold, still holds first place in silver output. This continent accounts for 76 per cent of the silver output of the world Mexico holds a position in silver suggesting that of the Transvaal in gold. It produces 44 per cent of the world's total from its rich deposits in the western mountains (p 287). This great silver producer has held an important position for four hundred years, the first large mine having opened in 1548. Although most of the silver comes from silver mines, a large part is produced in connection with gold, copper, lead, or zinc. In the United States, which ranks second, most of the silver comes from ores carrying other metals as the chief output of the mines (Fig. 237). Canada, Peru, Australia, and India are other significant silver producers

**Diamonds.** Among the large variety of precious stones, diamonds stand out as the basis of a huge industry, having an annual output many times greater than that of any other precious stone All of Africa mines about 96 per cent of the world's diamonds Nearly half of the total comes from an area about Kimberley in South Africa. There

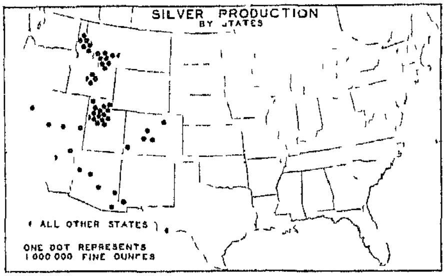
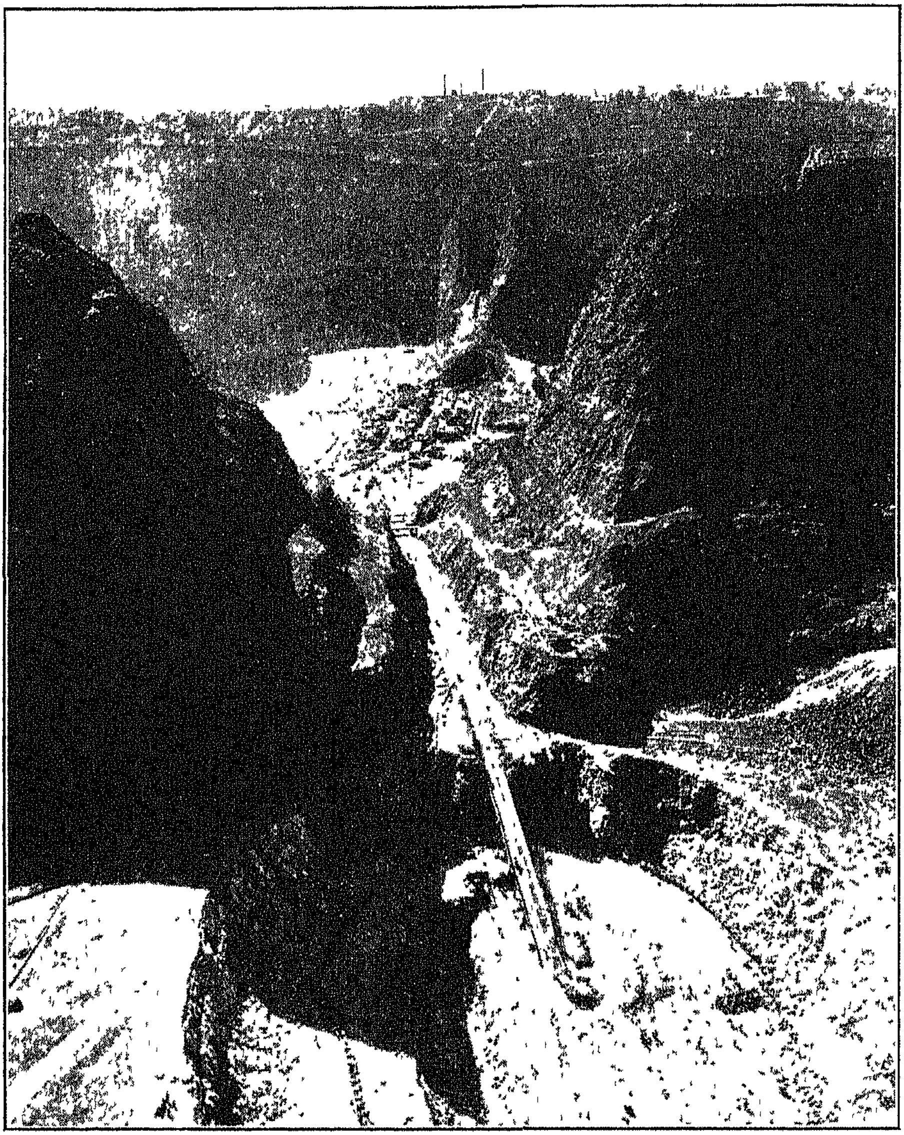



FIG 237 What three states produce two-thirds of our silver? Texas has one-half a dot, how much does that equal? What mountain region produces most of our silver?

one sees enormous pits from which a bluish rock is raised to the surface (Fig. 238). This is allowed to dry on the ground until crumbly, after which it is washed to remove the diamonds. Streams of muddy water flow over greased corrugated metal, only the diamonds stick in the grease A smaller supply of South African diamonds comes from alluvial workings, where the diamonds occur like gold in placer deposits What percentage of the world's diamonds do the Belgian Congo and the Gold Coast produce? Other diamond mining countries include southwest Africa, Angola, British Guiana, and Brazil Brazil at one time led the world.

## WHY SOME METALS AND STONES ARE PRECIOUS

While the basis for the great value of these metals and stones is their scarcity, they are precious for other



*Courtesy of South African Railways and Harbour*

PREMIER DIAMOND MINE, SOUTH AFRICA

FIG 238 The pit is so deep that men at the bottom appear like ants For each carat of diamonds the miners take out nearly one ton of bluish rock. Barbed wire entanglements surround the mines to keep the laborers from escaping The miners are Negroes who live inside corrals. The company has a special treatment for the Negroes who try to swallow diamonds, and a different one for those who do swallow them. If a laborer leaves the mines, he cannot return.

reasons. As we have seen, gold has always allured man because of its beauty, durability, and ease with which jewelry and ornaments were made from it Now its paramount use is as a standard of money recog-

nized by all the commercial world, about half of the world's gold being so used Silver, although worth much less than gold because of greater abundance, has many more uses Besides its use as a subsidiary monetary standard in some countries, it resembles gold in its value for works of art and it has considerable utility industrially in photographic materials and in accurate instruments for laboratories Platinum, exceeding gold in value, lacks a monetary use but, in addition to a demand for jewelry, it has important outlets in industry, especially electrical equipment

Precious stones depend for their value largely on rarity and beauty when artistically cut. Diamonds and to a slight extent rubies and emeralds have also an important place in industry Because it is one of the hardiest substances known, the diamond is used in many industrial operations for accurate cutting of other solid materials

## EXERCISES

1 Answer the questions under the pictures and maps in this chapter

2 Explain placer mining; vein mining

3 Why are these mineral products precious?

4 Make a list of the difficulties of mining (*a*) in the Transvaal, (*b*) in the Yukon, (*c*) in the Andes of Bolivia (use map).

5. Make one bar graph each by states for gold and silver production (p. 287)

## AN EXTRA LESSON

"The Discovery of Gold in California and its Influence" — **21**, I, pp. 167–190.

## READINGS[1]

"Mining and the Use of Gold in the United States" — **2**, I, Chapter XIII, **21**, I, pp. 167–190; **92**, pp. 91–98, **86**, pp 274 ff

"Men and Gold" — **C**, LXIII (1933), 481–518, many excellent photographs; **2**, I, pp. 194–204.

"A Trip through a Gold Mine" — **7**, I, Chapter XLVIII.

"A Trip through a Silver Mine" — **7**, I, Chapter XLIX.

"The Gold Rush to the Yukon" — **71**, Chapter XI.

"Minerals in Alaska" — **A**, II (1926), 532–534.

"Gold Mines of South Africa" — **2**, VI, pp 107–110, **7**, V, Chapter XLVI.

"The World's Gold" — **I**, III (1924–25), 478–488.

"Silver Mining in the Andes" — **85**, pp. 177–187.

"Silver Mining in the United States" — **2**, I, pp 209–211, **21**, I, 190–196.

"Diamond Mines of South Africa" — **2**, VI, pp. 93–99; **7**, V, Chapter XLV.

"The New Gold Rush in Colorado" — **P**, LXIII (*June*, 1934), 20 ff.

## TOPICS FOR INVESTIGATION AND REPORT

"Gold and Silver Mining District of Boulder, Colorado" — **B**, XXIX (1930), 271–286; **C**, LXII (1932), 5–18, 24, 25.

"Diamond Mining in South Africa" — **P**, LXII (1932), 29 ff.

"The World's Diamond Trade" — **B**, XXXII (1933), 290–294.

[1] Numbers and letters refer to Selected References on pages 420–424

## CHAPTER XXVII

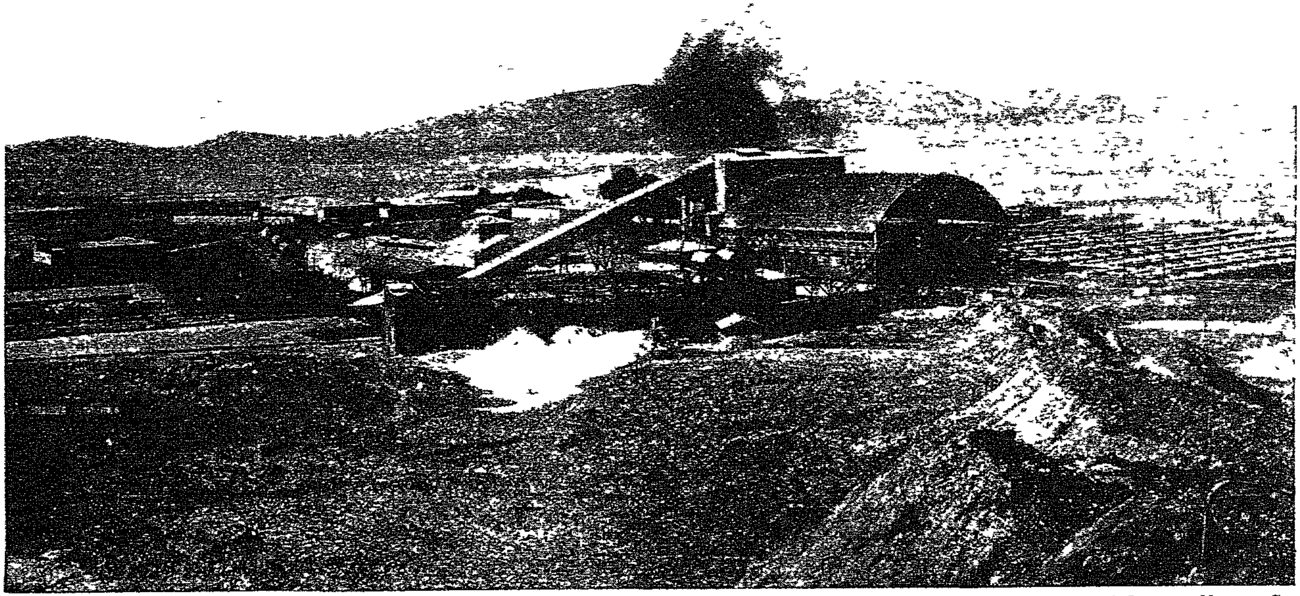
# MINERAL FERTILIZER PRODUCTS

**Chilean Nitrate.** Nitrogen is one of the most essential elements of plant growth. When it becomes too scant in the soil plants suffer, hence farmers use quantities of nitrogenous fertilizers. The most easily utilized supply of material for such fertilizers lies in the desert of northern Chile where occur the world's greatest deposits of sodium nitrate

**A Nitrate *Oficina*.** A visit to a huge nitrate-treating plant, or *oficina*, gives us an idea of the importance of nitrates Let us leave our steamer at Iquique, not an easy task as there is no harbor here and we have to take a launch from the steamer to shore. Iquique we find to be a town of forty thousand people and almost entirely dependent upon the nitrate industry. We learn that Iquique is one of the driest spots on the earth. It records an average of one rainy day a year and some years pass without any rain. The water at our hotel comes from the Andes by a pipe one hundred fifty miles long As we shall see, if much more rain fell probably no nitrate region would exist nearby. After climbing over the coastal range, which is practically bare of plant life, we reach the nitrate *pampas*, a level to gently rolling surface of sands, gravels, rock ridges, and salt flats stretching to the foothills of the Andes. We travel only a short way to the first nitrate workings — a huge set of buildings constituting an *oficina* (Fig 239)

We are now in the Tarapaca nitrate district. Four others stretch southward for several hundred miles — Tocopilla, Antofagasta, Aguas Blancas, and Taltal (Fig 240). Mining by the open pit method is easy, the nitrate stratum or *caliche* being capped with a thin layer of other materials. With dynamite the men tear loose large quantities of *caliche* and shovel it into cars to be hauled to the *oficina*.

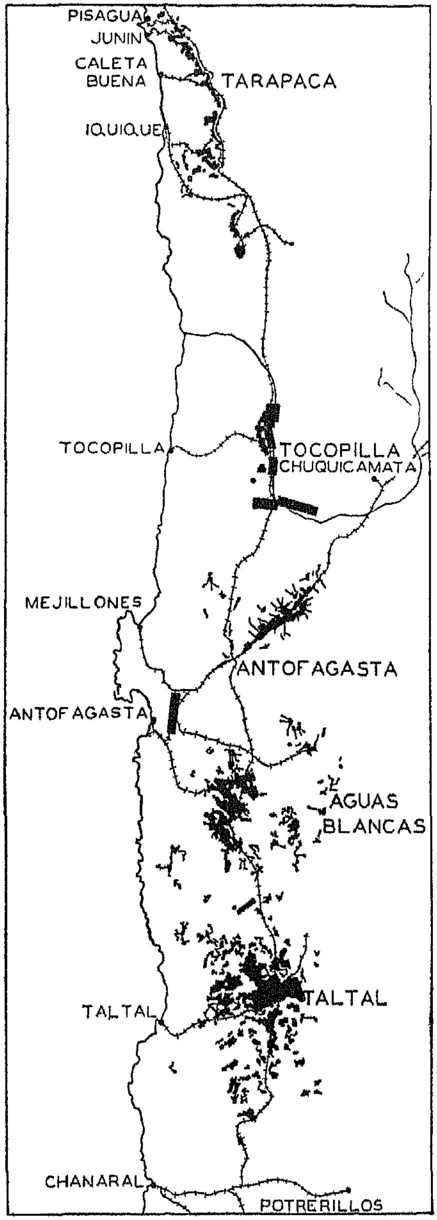
The *oficina* covers several acres At the *oficina* the *caliche* is crushed and boiled in huge tanks of hot water, the worthless part sinking to the bottom while the solution containing the valuable sodium nitrate flows to huge pans. As the solution cools white crystals of sodium nitrate form. The excess liquid is drawn off, the nitrate is allowed to dry, and then it is sacked for shipment. As we visit the *oficina* we remember that everything we see, other than the desert, has been brought in at great expense — men, food, supplies, animals, feed, structural steel, timbers, machinery, fuel, and water. But the world needed nitrogen and, to get it, spent millions of dollars on factories in the barren desert. Until recently nitrate mining was so profitable that Chile got half to two-thirds of its taxes from the nitrate industry while the industry accounted for 60



*Courtesy of Lautaro Nitrate Co*

OFICINA ACONCAGUA CHILE

FIG 239 In the center are the crusher the conveyor, and the boilers, on the right the settling tanks, on the left the buildings for machinery, animals, and laborers, all around stretches barren desert, the source of the nitrate All the men who work here and the equipment used were brought in from distant regions When the nitrate deposits are exhausted these huge mills will be torn down and the materials sold for what they will bring The people working here will have to migrate to other regions to obtain work




NITRATE REGION OF CHILE

FIG 240 In this barren desert is a great mining industry; note how each region has access to the sea.

per cent of the value of Chilean exports.

In recent years the Chilean nitrate industry has not fared well. As it has the only large natural nitrate deposits, for a long time Chile produced most of the world's supply not only of nitrates but of iodine, a valuable by-product, obtained from the liquid after the extraction of the nitrates Even with a great decline in the nitrate industry, Chile produces more than four-fifths of the world's supply of iodine. The iodine present in the *caliche* is more than sufficient to supply demands, only a fraction needs to be recovered Now Chile produces only one-fourth of the nitrogen of the world (Fig 241) The industry in Chile has declined greatly because the nitrate producers of Chile kept the price high, the Chilean government for a long time charged a tax of $10 50 on each ton exported, and the high price of nitrate caused Germany and other countries to develop processes of producing nitrogen artificially These processes, at first expensive, have been improved so that now synthetic nitrogen can be produced as cheaply as natural nitrogen

**Synthetic Forms of Nitrogen.** Most of the world's supply of nitrogenous materials now is made in factories nearer the area of consumption. This development seriously injures Chile. About one-third of the synthetic nitrogen comes from ammonia obtained as a by-product in coke making, another third from synthetic ammonia, and the remainder from a process using the nitrogen in the air by means of tremendous electrical power.

**Commerce in Chilean Nitrate.** Little of the sodium nitrate is used in Chile. It goes to regions in the Northern Hemisphere where the soils are poor, either because of natural poverty or because of soil-depleting agriculture. The United States takes

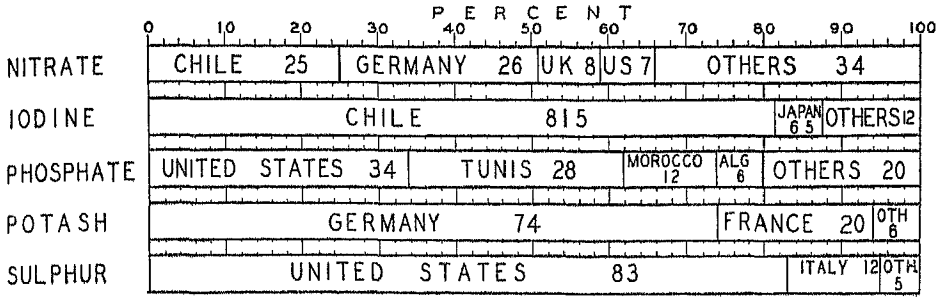


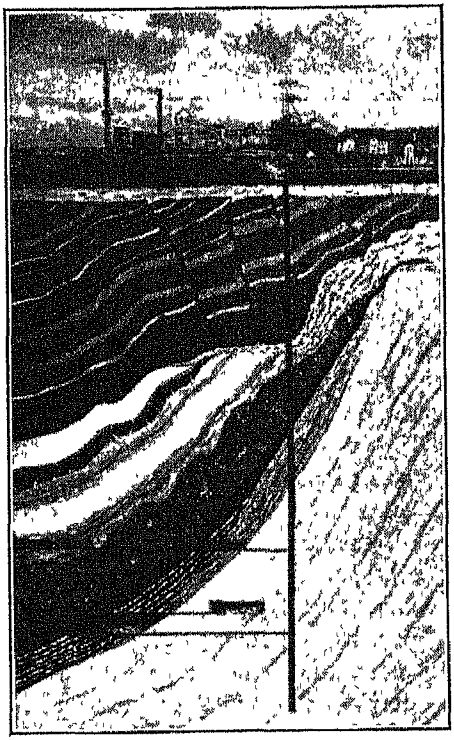

FIG 241. The graph shows the important producers of several mineral products. Only the nitrate produced by Chile is mined; how is the remainder produced? Note the position of the different countries in the production of these products. One of the chief uses of sulphur is for materials in fertilizers

about one-third of the Chilean export. To what part of the United States would you say most of this goes (p. 297)? Practically all the rest goes to western Europe

**European Potash** Potassium is another of the essential elements for agriculture which must be replaced by artificial fertilizers. This necessity is not nearly so easily obtained as sodium nitrate, nor has any method been devised to manufacture a synthetic product. Two small areas turn out 94 per cent of the world's potassium salts, the source of commercial potash

One of Germany's most valuable resources has been the potash mines about the city of Stassfurt. About eighty years ago men drilling for rock salt discovered potassium salts in a broad area encircling the Harz Mountains (Fig. 242). It has been estimated that Germany's reserves of potash are enough to supply the world's needs at the present rate of consumption for two thousand years. Before the World War Germany controlled practically all of the world's supply; the cession of Alsace to France gave that country an important part of the resources.

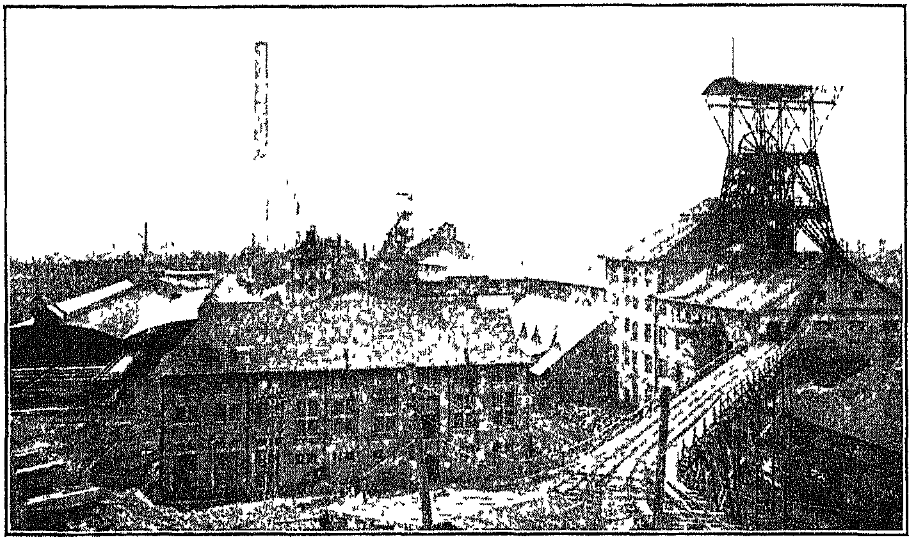
In contrast to the Chilean nitrate



*Courtesy of N V Potash Export My, Inc.*

CROSS-SECTION OF GERMAN POTASH MINE

FIG 242. The chief potash salts are in the dark, streaked layer next to the bottom The bottom, or thick white layer, is rock salt. The rock, taken out in chunks, is pulled to the surface by machinery (shown in the center), sent through crushers, and to the leaching vats where the potash salts are dissolved and later evaporated



*Courtesy of N V Potash Export My, Inc.*

POTASH PLANT, GERMANY

FIG 243 The machinery on the left pulls the rock up the shaft and sends it through the crushers to the treating vats in the center; the evaporating sheds and pans are on the left

industry, which represents the only important activity in the desert, the German potash region has many highly developed industries. Many of these depend directly upon potash and have constituted one of the main reasons for Germany's great chemical industries. Potash goes not only into fertilizers but into soap, glass, matches, explosives, dyes, photographic materials, etc (Fig 243)

Even more important for Germany has been the value of potash in the country's agriculture Its productive sugar-beet and potato regions use about two-thirds of the potash. The United States buys about one-eighth of the production and the rest goes largely to other European countries

Near Mulhouse in Alsace lies the world's second greatest deposit of potash. This contains much less potash than that in Germany, but the mineral averages a higher grade. It now contributes about 20 per cent of the world's output and, like the German product, has played a valuable part in the recent development of French agriculture.

**American Potash Resources.** The United States, so richly blessed in most minerals, lacks a large potash industry Before the World War this country depended almost entirely on the German deposits, but when this supply was cut off the country had to search for domestic resources. The main efforts were in the beds of dried-up salt lakes in the arid west, especially at Searles Lake in California. Small amounts came also from a variety of California seaweed, various industrial waste products, and a few rocks containing potassium minerals. In all, however, the output was only one-fourth of the amount needed. Since the war the United States has fallen back on the German supply.

**United States Phosphates.** In decided contrast to America's deficiency in potassium materials is its richness in phosphorous minerals, phosphorous being the third great requisite for plant growth. The United States contributes more than one-third of the world's total. Europe has little production in its own boundaries, but in the colonies there are enormous deposits, French North Africa — Tunis, Algeria, Morocco — produces half of the world's output

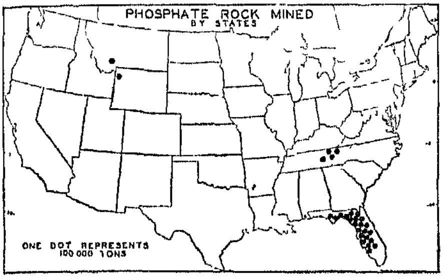
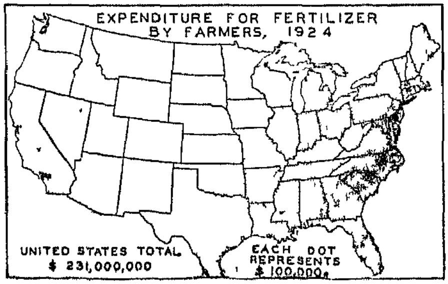



FIG 244 What percentage of our phosphate does each state produce?

Florida is the center of the United States industry, producing four-fifths of the total, Tennessee mines giving most of the remainder (Fig. 244). Several factors account for the preeminence of Florida. It has enormous deposits of the lime phosphate rock from which the phosphorous is obtained These lie so near the surface as to make pit mining possible. Moreover, all of Florida lies near the sea. Finally the region lies near the agricultural area needing most fertilizer — the cotton belt (Fig. 245). Tampa has fine shipping facilities for the phosphates which go from this country to foreign markets.

The lime phosphate rocks of Florida and northern Africa represent chiefly the bones of fossil animals The bones of slaughtered animals also furnish phosphorous, the packing industries prepare large amounts of ground bone for fertilizer Another source of phosphorous, more commonly used in Europe than here, is basic slag, a by-product of the steel industry




*Courtesy of United States Department of Agriculture*

FIG 245 Nearly all the fertilizer is used in the eastern part of the country with intensively tilled crops — cotton, tobacco, fruits, vegetables — and on rather sandy soils where the rainfall is heavy

**United States Sulphur.** The United States produces most of the world's sulphur, nearly all of which comes from Texas. The method of mining sulphur differs considerably from that of nitrate and other minerals. Wells are drilled into the sulphur ore and water heated to 300 degrees Fahrenheit is pumped into the sulphur under pressure. This dissolves the sulphur. After being pumped out the liquid is refined for the sulphur.

## EXERCISES

1. (*a*) Explain the process of producing nitrate (*b*) Under what disadvantages does the industry work? (c) Why has the mining of nitrates declined? (*d*) Explain the position of Chile in iodine production.

2. (*a*) Explain why foreign trade in these mineral products is necessary. (*b*)

For what products must we depend on foreign sources? (*c*) Compare the position of the United States in these mineral products with those in the previous chapter

3 Oral composition Mining and treating nitrate; text and 33, No. 2, pp. 1–11; 75, pp. 150–159.

4. The decline of the Chilean nitrate industry, 17, pp 163–166

## TWO EXTRA LESSONS

I "The Evolution of the World Nitrate Industry" — readings

II "The Sulphur Industry of the United States" — B, XXX (1931), 221–231, 7, I, Chapter XXV, look up, also, the uses of sulphur

## READINGS [1]

"Chilean Nitrate and the Nitrogen Revolution" — A, VII (1931), 273–283

"A Visit to the Nitrate Region" — 33, No 11, pp 1–13, 75, pp 156–159; 17, pp 153, 161–165, 7, II, Chapter XVII

"Potash Industry of Europe" — A, V (1929), 141–148, 104, No 449, 105, No 33, pp 42 ff

"The Use of our Phosphate Resources" — A, I (1925), 387–395; A, IV (1928), 366–380

"Fertilizing our Cotton Fields" — 4, Chapters XI and XII

## TOPICS FOR INVESTIGATION AND REPORT

"Uses of Nitrates" — 33, No 11; 4, Chapters XI and XII

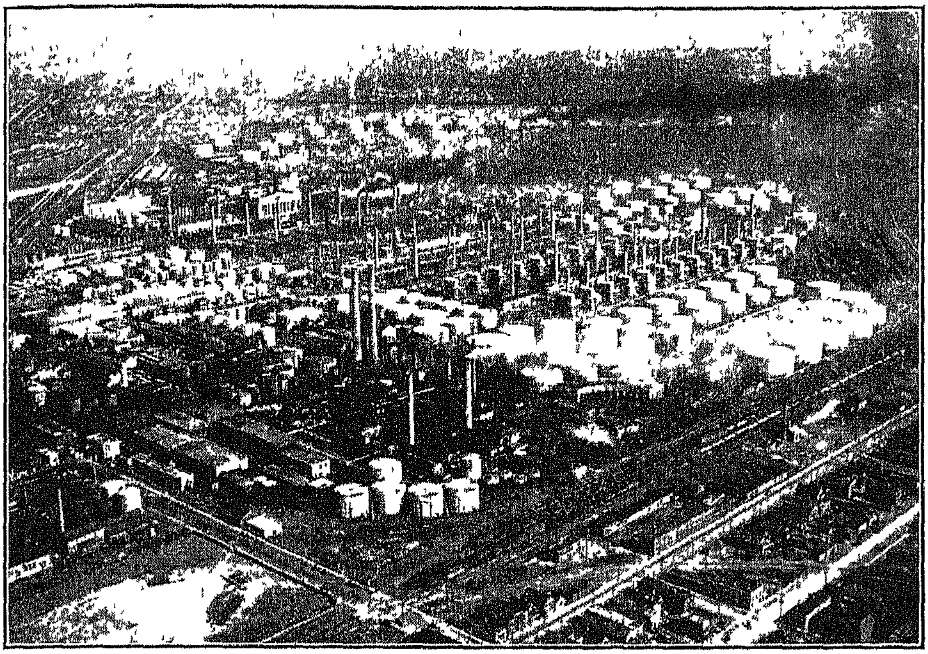
"The Use of Fertilizers" — 16, pp 190–195.

"American Potash for America" — C, XXII (1911), 399–407, excellent pictures

"Our Fertilizer Resources" — A, IV (1928), 366–380.

"The Trade in Iodine" — 104, No. 561.

[1] Numbers and letters refer to Selected References on pages 420–424.



*Courtesy of Chicago Aerial Survey Co.*

OIL REFINERIES, WHITING, INDIANA

FIG 246. Petroleum has given rise to one of our great mining industries and to a great manufacturing industry From the maps on pages 301, 360, and 404, and from the text tell why this great plant developed at Whiting Locate homes of laborers, railway, tanks, and refinery.

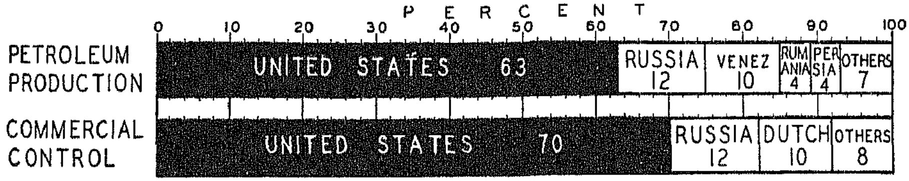
## CHAPTER XXVIII

# PETROLEUM AND NATURAL GAS

**Whales and Oil Wells.** The limited supply of whales is partly responsible for the inception of some world-wide major industries. If these great mammals had been more plentiful the petroleum industry might not have started until some time later than 1859. For many years prior to that date, whales were sought mainly for illuminating oil rendered from their blubber. But the demand for whale oil in northern Europe and America became so large that whales could not supply it. With higher and higher prices the consumers of whale oil began seeking substitute materials

Petroleum had been known for centuries, but people regarded it as something polluting their springs rather than as a wonderful raw material. In 1859 the world's first oil well was dug in Pennsylvania. The discovery of petroleum and the methods of using it not only solved the problem of declining whale oil supplies, but gave the world hundreds of new valuable commodities

**The Uses of Petroleum.** For some




THE PRODUCTION AND COMMERCIAL CONTROL OF PETROLEUM

FIG 247 In addition to the petroleum companies producing in the United States, American companies operating in foreign fields give us control of 70 per cent of the world's output of petroleum The British Empire has control of only 6 per cent

time petroleum was regarded as only a source of illuminating material Then it became known as a lubricant and finally, but much later, as a source of power. Today it is one of the most essential raw materials. Although electricity lights millions of dwellings, more people still use kerosene, a petroleum product, than any other illuminant Petroleum furnishes the best and most abundant lubricants known, and some authorities claim that without such lubricants machinery, the basis of our modern civilization, could not have been developed, for much machinery depends on high speed and requires a satisfactory material to reduce friction. In some ways petroleum's usefulness as a lubricant is its most important gift to mankind, for we know of no good substitute, whereas we have many possible substitutes for other uses of petroleum.

At present, however, the mining of petroleum owes its development chiefly to the great value of this mineral as a source of power. Gasoline is its best known product producing power, but tremendous quantities of fuel oil are used to run steamships and locomotives, to furnish power in factories, and to heat buildings. Besides these major uses, petroleum produces such useful commodities as petroleum ether, naphtha, benzine, petroleum jelly, paraffine, wax for candles, tar, vaseline, and many medicines, and from the tar a huge variety of aniline dyes (Fig 246)

## PETROLEUM INDUSTRY IN THE UNITED STATES

**Migration of the Petroleum Industry.** The United States is the only important industrial nation that has enormous supplies of petroleum within its own borders Moreover, the areas of production are so widely scattered that the country benefits from the savings in transportation costs Since 1859 few years have passed in which the national output did not increase, we produce almost one billion barrels a year, nearly two-thirds of the world's output (Fig 247)

The industry has had many changes At one time Pennsylvania and New

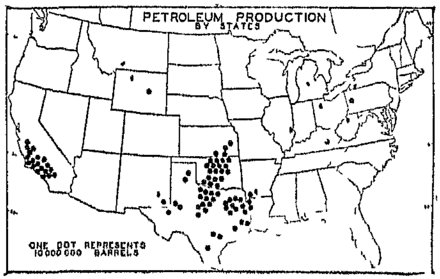



FIG 248 How many states produce oil? How much did Texas produce in a recent year? Ohio produced five million barrels; Colorado has one-fourth of one dot, which equals two and one-half million barrels What part of our petroleum do the leading four states produce?

York had the chief wells, later wells in Ohio and Indiana surpassed them In the early part of the twentieth century the rich mid-continent field rose to leadership, for a time recently California led the country, today Texas has the greatest output (Fig 248)

**Petroleum in Plains and Plateaus.** The map of United States petroleum regions shows strikingly the fact that petroleum is an industry of relatively level areas. As we have learned, if rocks containing petroleum are formed into mountains, the fluid material may escape. Producing regions lie in areas of sedimentary rock which have undergone little folding The oil-bearing strata are porous rocks, like sandstones, where organic matter has slowly accumulated while the beds were formed and later changed into petroleum. Sometimes the productive rocks lie near the surface — the first American well was less than one hundred feet deep — but commonly they are much deeper, as much as a mile in some cases.

**Oil Well Drilling.** To obtain petroleum engineers erect tall structures, or derricks, which support drilling machinery As the drill eats into the earth, the hole it makes is lined with steel pipe Geologists carefully examine the rocks through which the drill goes for an indication of the position of oil-beds. In some cases when the oil is reached, the pressure behind it is so great that it spurts into the air a hundred feet or more, and then engineers have a hard time controlling the well in order to collect and store the oil. Usually the oil has to be pumped out and stored in huge tanks.

**Oil Rushes.** Drilling does not always lead to oil. Nearly one-fourth of the wells drilled are dry holes. But when oil is found the expense of drilling often is repaid hundreds of times The rush to new oil lands recalls gold rushes, but the petroleum in a good area produces even more wealth than a gold field The state of Oklahoma has many illustrations of how the discovery of large oil fields changes a land

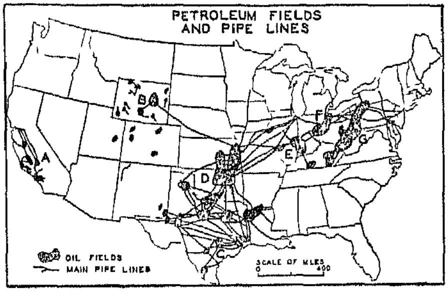



FIG 249 The petroleum fields include A, California, B, Rocky Mountains, C, Gulf coast, D, Mid-continent, E, southern Illinois, F, northern Indiana, Ohio, and G, Appalachian What part of our petroleum is produced by fields A, C, and D? Note the distribution of pipe lines Which fields are favored by a coastal location? Which fields lack transport facilities? Which fields now produce little oil?

In 1900 Oklahoma City had 10,000 people and now it has 185,000; Tulsa had 1,000 and now has 140,000. Other cities in producing regions that had a rapid growth partly because of petroleum are Los Angeles, Houston, Dallas, and Fort Worth Refining centers also have shown remarkable growth. They are generally in ports, in market regions, or areas with excellent transportation. Thus New Jersey, producing no oil, ranks third in the refining of petroleum.

**Transporting Oil.** Although highly inflammable, oil has an advantage over coal in the ease with which it is handled and transported. Some of it is carried in barrels and in motor truck tanks, a larger quantity in railway

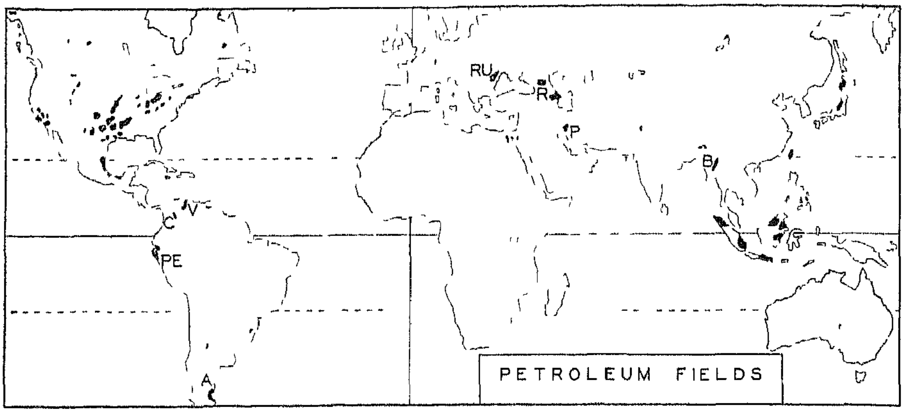


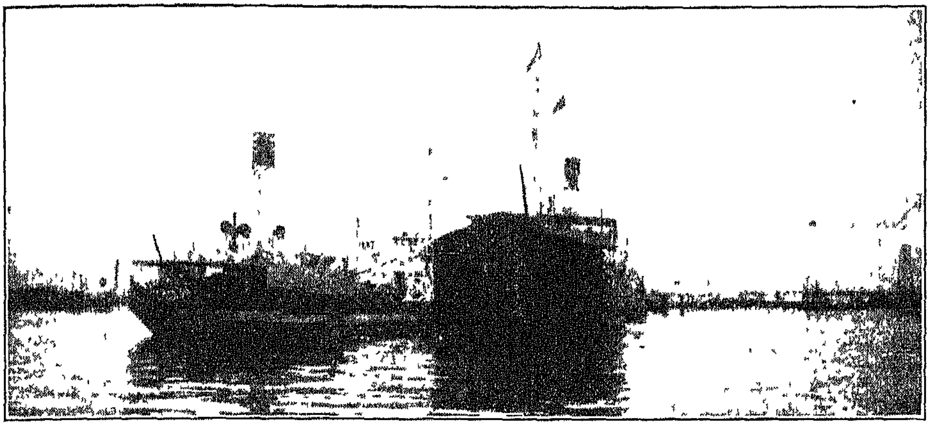

FIG 250 V, Venezuela, C, Colombia, Pe, Peru; A, Argentina, Ru, Rumania, R, Russia, P Persia, B, Burma Petroleum is produced in many regions of the world, but a few countries pump most of the oil Is petroleum produced chiefly in plains or mountains? Why? How many large fields are in regions of dense population? What regions use most of the petroleum products? What large fields are near the sea? How many regions has South America? Which continents have very few petroleum fields?

tank cars, but the most important method for long distance transport on land is the pipe line, which consists of pipes several inches in diameter (Fig. 249). The United States has one hundred thousand miles of these pipe lines Some of the oil moves through pipe lines for seventeen hundred miles; the average distance is three hundred miles The pipe line leads either to tank steamers which consist of a number of compartments into which the oil flows, or it supplies the storage tanks of an oil refinery.

**Oil Refining.** As petroleum comes from the well it is a thick brownish-black or dark greenish-brown liquid and is known as "crude." Some of it is used in this form for power and for other purposes Most of it is refined. The United States has several hundred refineries, ranging in size from small plants found near the oil fields which distill off gasoline and kerosene and sell the remainder as fuel oil, to stupendous establishments in large cities or seaports which handle one hundred thousand barrels of oil daily and turn out numerous petroleum products

Great tanks store the petroleum brought by pipe line to a large refinery, at Chicago or New York for example, (p. 299). As needed this supply goes to tall steel towers containing stills where, by heating the petroleum to various temperatures, the numerous products are obtained. About two-fifths of the petroleum becomes gasoline, two-fifths gas oil and fuel oil, one-twelfth kerosene, and one-twentieth lubricants.

**Commerce in Petroleum Products.** Petroleum not only furnishes one of the major domestic industries but it is one of the country's greatest exports. American petroleum products are very widely distributed in foreign markets, comprising the second most important export of the United States. Gasoline accounts for about half of the value, lubricants about one-fifth, kerosene one-sixth, gas and fuel oil one-thirteenth Petroleum products are shipped to nearly every country in the



OIL DERRICKS AND TANKERS, LAKE MARACAIBO

FIG. 251 In few places can oil be produced and shipped so cheaply

world, but the United Kingdom, France, Japan, Canada, and China take more than two-fifths of our exports. Industrial countries take many products, but China and backward countries take chiefly kerosene. Because of its refining facilities and also because of advantages in regard to location, the United States imports about one-tenth as much petroleum as it produces, mostly from Venezuela.

## FOREIGN PETROLEUM REGIONS

**Mexico.** The history of Mexico's oil industry shows how petroleum almost overnight changes the character of a region. Ten years ago Mexico ranked next to the United States as a producer of petroleum (Fig. 250). The great oil field in the coastal plain near Tampico was one of the most sensational of all discoveries. Tampico became the greatest oil-shipping port in the world. At present Mexico has an output only one-eighth as large as in 1921 and ranks sixth among the countries producing petroleum. This decline is due to the exhaustion of wells, to the controversies caused by the attempts of foreign companies to gain as much as possible of the industry without much benefit to Mexico, and to government restrictions imposed on the operation of the oil companies.

**Venezuela.** In the lands about the Gulf of Maracaibo in recent years another remarkable development has taken place. In the past ten years production in this rich oil region has multiplied many fold, until Venezuela has become a large producer. The fields are in and near Lake Maracaibo. The wells are shallow, most of the wells drilled produce abundant oil, labor is cheap, ocean steamers take much of the oil direct from the wells, and the president of Venezuela permits foreign companies to produce and ship the oil (Fig. 251). Because of the oil Maracaibo has grown to be a large modern city.

**Russia.** In 1900 Russia led the world in oil production; today it ranks second. Where are the oil fields of Russia? In contrast to Mexico and Venezuela, much of the oil stays in Russia. Some goes to the interior by means of tankers on the Caspian Sea

and the Volga River The rest goes by a pipe line 560 miles long to the port of Batum on the Black Sea From Batum, a large quantity goes to countries of western Europe

## NATURAL GAS

For many years, a gas escaping from oil wells was regarded as a nuisance in many regions Today it forms the basis for one of the most rapidly growing American industries — the natural gas industry Today the value of natural gas sold annually in this country is more than twice as great as ten years ago and the natural gas pipe-line system has a length of seventy thousand miles Some natural gas is piped from Texas to Chicago, but most of it moves a shorter distance and is used chiefly in the states of Texas, Oklahoma, California, Louisiana, Ohio, and Pennsylvania About two-fifths of the product is used as fuel in the oil industry, one-fifth for manufacturing, and one-fifth for domestic use Now instead of being wasted, this petroleum product is valued as the best and most conveniently used of all fuels, as well as the cheapest

## EXERCISES

1 (*a*) What led to the first large use of petroleum? (*b*) Make a list of the uses of petroleum today. (*c*) How do the important uses rank? (*d*) Why did the petroleum industry in the United States migrate?

2. Contrast the method of producing petroleum with that of nitrate.

3 Answer questions under Figs. 248 and 249

4. Explain the distribution of pipe lines in the United States.

5. Answer questions under Fig. 250.

6. Why did Mexico's output decline so rapidly?

7 What six conditions favor the production of petroleum in the Maracaibo region?

8 From the map on page 300 make a graph, using bars for different states, showing petroleum production by states. Let one inch represent 100,000,000 barrels.

9 Make a table giving our position in the production of the minerals studied as follows:

| Mineral | Percentage of world by United States | Other countries that produce more than 33 per cent of the total | |
|---|---|---|---|
| Gold | 15 | Transvaal | 48 |

## THREE EXTRA LESSONS

I. "The Oil Refining Industry of the United States" — From the Census Manufacturing make a dot map of petroleum refining by states and discuss the factors that account for the distribution of the refineries, text, 12, pp. 332–334, 339–343; 7, I, Chapter XXVII; 21, I, pp. 62–68; 79, pp. 366 ff.

II. "The Natural Gas Industry of the United States" From the Census make a map of the production of natural gas by states; 21, I, pp. 69–74; 94, pp 174–177; 92, pp. 55 ff.

III. "The Mining of Asphalt and its Uses" — 33, No. 1, pp. 1–28; 17, pp 695–697; B, XXIV (1925), 212–220.

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"Petroleum in General" — 16, pp 226–234, 2, I, pp 158 ff, 94, pp 168 ff, 86, pp 174 ff

"Drilling for Oil" — 20, I, pp 189–198, 207–211, 21, I, pp 45–58; 12, pp 336–339

"Conservation of our Petroleum" — 92, pp 43–55

"The Oil Tanker" — Literary Digest, November 6, 1926, pp 56–62

"Kilgore Texas — An Oil Boom Town" — A, IX (1933), 72–84

## TOPICS FOR INVESTIGATION AND REPORT

"Petroleum Resources" — A, I (1925), 138–142

"The Petroleum Fields of the United States" — 7, I, Chapter XXVI, 12, pp. 335 ff., 94, pp 168 ff, 1, pp 114–119

"The Story of Gasoline" — 55.

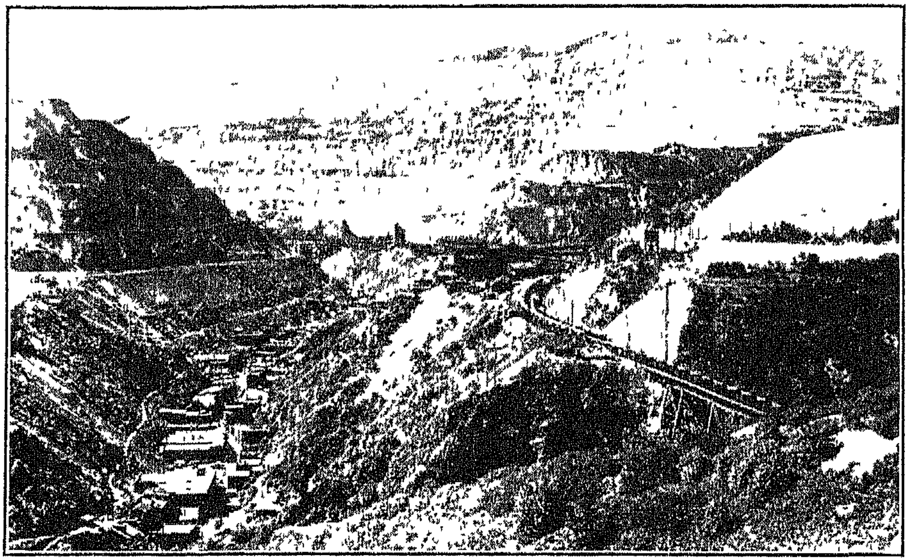
"Importance of Pipe Line Transportation" — A, VIII (1932), 191–204, 21, I, pp 59–62, 79, pp. 301–332, P, LXII (February, 1934), 22 ff

"New Oil Fields of South America" — 17, index

"World Trade in Gasoline" — 105, No 20

"World Resources" — I, VI (1927), 89–105, 79, index, A, I (1925), 138 ff

[1] Numbers and letters refer to Selected References on pages 420–424



*Courtesy of L S Gillham Co*

NORTH AMERICA'S LARGEST OPEN-CUT COPPER MINE, BINGHAM, UTAH

FIG 252 The mountain of copper ore is blasted and loaded on trains on twenty levels Locate trains of cars on different levels On the left are the homes and stores of the miners Almost no copper is used at the mine After treatment, it is sent to the manufacturing region of east central North America

CHAPTER XXIX

# MINING NON-FERROUS METALS AND MINERALS

## § I — COPPER AND TIN

**Bingham, Utah.** On the eastern slopes of a mountain twenty-eight miles southwest of Salt Lake City lies one of the world's greatest copper mining districts (Fig 252). The mine in Bingham Canyon has a world-wide reputation because of the immenseness of its activities and resources In one year this mine produced one hundred fifty thousand tons of copper, or about one-fourteenth of the entire world's output. Eighteen million tons of ore were mined and transported to concentrating mills that year. Yet thirty years ago even experts were not optimistic about the deposit, because they considered the ore too low a grade At that time underground workings were used But the improvement in mining methods and metallurgy a few years later made Bingham the renowned district of today

Entering the canyon, one sees a long town at the bottom, the settlement being only a few houses wide. On the slopes, he sees a series of immense terraces connected by railroads. These terraces represent the mine. The deposit consists of a mountain of copper

ore blasted and mined by steam shovels. These scoop huge masses of ore and dump them into waiting freight cars. On a single day hundreds of these cars are loaded

Bingham copper ore is of low grade, but the conditions of mining are so favorable that the company is a big one. The ore cars go down the various terraces largely by gravity and then they have an easy descent to the enormous mills at Garfield, twenty miles from Bingham The first step in treating the ore takes place in concentrating mills Coal from north-central Utah furnishes power In the mills the ore is "enriched" until it contains from 3 per cent to 8 per cent copper. "Roasting" follows, in which the proximity of coal greatly helps, because much power and heat are needed "Roasting" occurs in the smelter at Garfield "Roasting" is necessary to drive off the sulphur which generally is found with copper. It produces "copper matte," an impure mixture of metals containing about 50 per cent copper. The final process in the mining district purifies the copper in great converters and produces "blister copper." For some purposes "blister copper" will do as it is, but for most uses it is not pure enough and besides it may contain silver and gold. If required, the final purification takes place in refineries where there is plenty of electric power available, the greatest refineries being on the Atlantic seaboard By an electrical process the refineries produce pure copper and in some cases enough silver and gold to pay the cost of refining.

**Copper in Arizona.** Arizona leads in copper mining (Fig 253). In a recent year it produced one-fourth of the world's copper, a quantity larger than that for any foreign country Whereas Utah's copper comes from a relatively small area near Salt Lake City, the Arizona deposits occur in widely separated places, mainly in the Bisbee, Jerome, Morenci, Metcalf, and Globe-Miami districts These towns illustrate how man will live in almost inaccessible places in order to carry on mining All their activities depend upon copper, about them stretch arid mountains Men, animals, food, clothing, and machinery come in from other areas and the copper goes chiefly to eastern United States for manufacturing Strong companies and great skill are required to work the huge deposits of low-grade ores.

**Copper in Montana.** Montana holds third place among the states as a copper producer Its mines about Butte are famous, having yielded more than $1,000,000,000 worth of metals Gold and silver mining preceded copper, because they had higher value and could pay for the expense of transportation in early days. Here the mines are underground, but the ore is rich The great smelters at Anaconda, Butte, and Great Falls have large

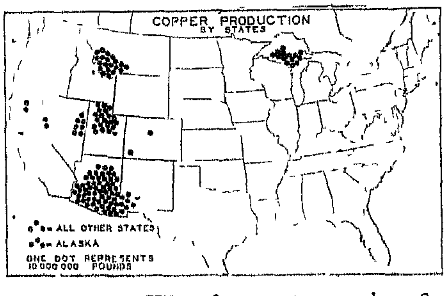
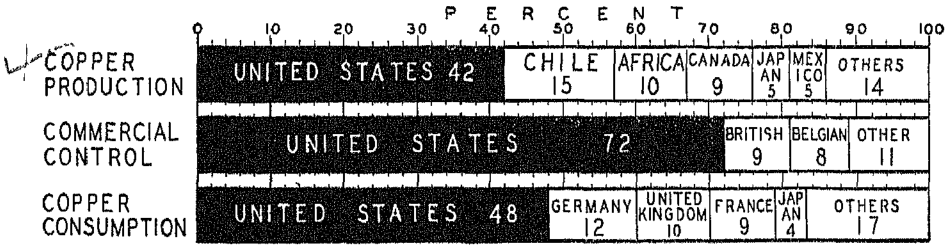



FIG. 253 What four states produce 80 per cent of our copper? What percentage of the copper of the United States does Arizona produce? Compare with Fig 237.

power plants Four of Montana's six largest cities — Butte, Great Falls, Helena, Anaconda — depend upon copper as their main business

**Copper in Michigan** Fourth among copper areas of the United States is the Keweenaw Peninsula of Michigan Earlier it led the country for many years Besides its long heavy production, the district is famous for its "native copper" This copper occurs in large quantities in pure form, the copper only having to be separated from the rock The district enjoys a great advantage in its location near

which costs much more, it is the finest conductor of electricity It has many other uses Since 1900 the world's output has grown fourfold The United States produces more than two-fifths of the world's total (Fig 254) Also it has commercial control of 72 per cent of the world's copper production Chile's copper, now nearly one-sixth of the world's total, comes almost entirely from American-owned mines, one of which, located at Chuquicamata where copper is mined as at Bingham, has the largest known reserve in the world. In addition




THE POSITION OF THE UNITED STATES IN THE COPPER INDUSTRY

FIG 254 What percentage of the world's copper do the leading four countries produce? East central North America and west central Europe consume 90 per cent of the world's copper Explain how the United States has commercial control of 72 per cent of the world's copper production Belgium gets copper from the Belgian Congo

the Great Lakes, a factor accounting for the profits still made despite mining difficulties due to the fact that some mines are now more than a mile deep The deep shafts, large tunnels, pumping in fresh air, pumping out water, blasting the native copper, and lifting it to the surface are heavy expenses that did not have to be considered before the metal nearer the surface had been removed.

**United States Leadership in Copper Mining and Consumption.** Since the rapid development of electrical work, copper has become one of the indispensable metals. Except for silver,

American men and capital have gone into distant desert and mountain lands abroad to get copper (Fig. 255) The United States uses nearly half of the world's copper and exports copper to many countries.

In contrast all the countries of Europe produce less than 10 per cent of the world's copper but they use nearly half the total. Africa and Canada have large deposits which help to supply Europe. The African deposits, though far inland in central Africa, contain enormous reserves for the future Japan, the leading copper consumer of the Far East, produces

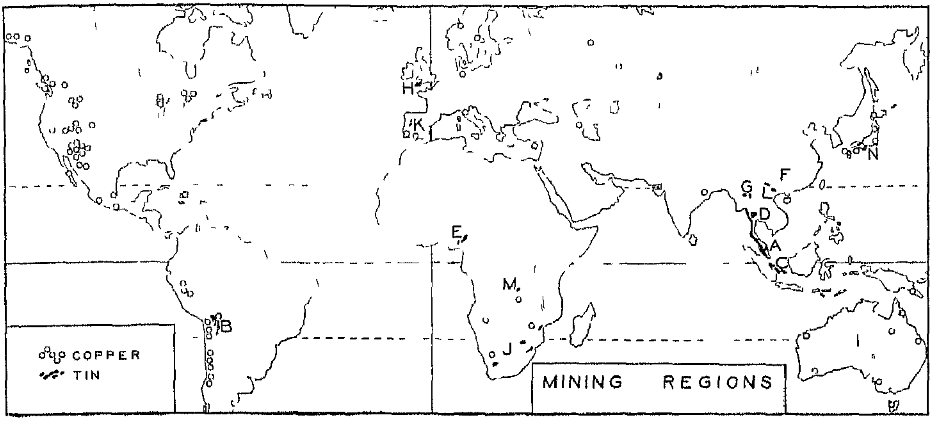



FIG 255 Many regions produce copper, but a few have most of the great copper mines of the world. Are the copper mines mostly in mountains or plains (pages 10–11)? Regions of sparse or dense population (pages 4–5)? Near or far from manufacturing regions (page 337)? Which two continents produce little copper?

Tin producing regions in order of importance A, Federated Malay States, B, Bolivia, C, Netherlands East Indies, D, Siam, E, Nigeria, F, China, G, Burma, H, England, I, Australia, J, southern Africa, K, Spain and Portugal, L, Indo-China, M, Belgian Congo, and N, Japan Regions in Asia and Bolivia produce 90 per cent of the world's tin Australia has several mines but produces only one per cent of the world's tin North America and Europe produce little tin, but they manufacture all the supply of tin products

more than western Europe and takes care of its own requirements

## TIN

In striking contrast to copper, the United States produces practically no tin, although it uses one-half of the world's output, chiefly in the canning and automobile industries.

**Tin in Asia.** The mainland and islands of southeastern Asia produce nearly three-fourths of the world's tin. Name the countries in this region that produce tin

In southern Asia most of the tin comes from gravels near the surface. Here are scenes much like those of gold placers in California or Alaska. In enormous open pits, powerful jets of water wash the tin minerals into sluice-boxes.

In some places huge pumps lift the gravel from the deposits to the washing trays In others large bucket-dredges or suction-dredges lift the gravels Some of the pumps and dredges are huge floating affairs Here many Chinese laborers work for extremely low wages. Although the climate is unfavorable the industry has the advantage of rich gravel deposits, low labor costs, and nearness to a great seaport. In Malaya and the Netherlands East Indies is a large smelting industry. Plants in the United Kingdom smelt most of the rest of the world's tin Much of the tin is refined and manufactured in the United Kingdom because the industry had an early start in South Wales The region has much high-grade coal and a skilled labor supply. The United Kingdom has commercial control of about two-fifths of the world's tin production.

**Tin in Bolivia.** The Bolivian tin

TIN CONCENTRATING MILL, BOLIVIA

FIG 256 The steep mountain slope is a good site for this huge concentrating plant, where the tin ore of 3 per cent tin or less, crushed to a powder, is concentrated to as much as 70 per cent tin by moving slowly in water over shaking tables, one after the other, in each level of the mill How many levels has the mill?

industry greatly differs from that of southern Asia. The tin ore has to be mined from rock situated in a cold, elevated region far from the sea (p. 309). Transportation is by pack animal, truck, or train across deserts and high mountains. The laborers are chiefly unskilled Indians. The region has no coal, no oil, and almost no wood for fuel. But the deposits are productive and for a long time tin has dominated Bolivian industry, contributing almost three-fourths of the export value. As fuel is scarce, labor poor, and machinery must be imported across the high mountain districts, no smelting or refining is done in Bolivia (Fig. 256). Instead the ore is concentrated until the material contains from 55 to 70 per cent tin. Nearly all the concentrates go to the United Kingdom.

**Uses of Tin.** The lack of tin ores is a handicap to the United States. The use of tin as a covering for steel in making tin cans has become so general that few of us pass a day without eating something that comes from a tin can. Tin also has much usefulness in Babbitt metal, used for bearings, as well as in solder, bronze, tubes, and type metal. The United States mines no tin but it produces tin by recovering it from discarded tin-containing materials. Tin produced in this way is called secondary tin Nearly one-third of the national requirements are now provided in this way. As we smelt no primary tin where do we get the remaining two-thirds of our requirements? As with copper, the tin-producing regions consume almost none of the output. Tin plate, which uses nearly half of the tin, is made by coating steel sheets with tin, tin plate contains 1.5 per cent of tin by weight. One pound of tin will make two hundred twenty square feet of tin plate. Therefore tin is taken to areas of iron and coal in order to make tin plate and other tin products; as an alloy metal, it is used in small quantities compared to the basic materials, consequently it moves to them.

## EXERCISES

1 Contrast copper production in Utah and Michigan

2 (*a*) Answer the questions under Figs. 254 and 255 (*b*) What are the important uses of copper? (*c*) What two regions consume most of the world's copper?

3. (*a*) Contrast tin mining in Malaya and Bolivia. (*b*) Why does Bolivia smelt but little tin?

4 From the text trace the chief world trade movements in tin Explain fully "why tin is taken to northwestern Europe and east central North America to be manufactured into tin plate and other tin products."

5 Make a bar graph of copper production by states (Fig 253)

6. Continue the table started in Chapter XXVIII

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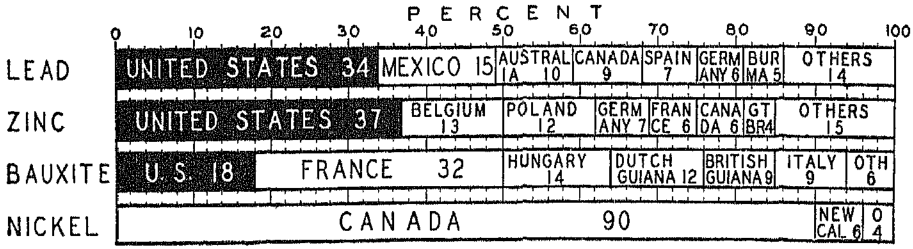
## § II — THE MINING AND USE OF OTHER NON-FERROUS METALS AND MINERALS

The world mines and uses many minerals and metals, but the principal ones in amount are iron, coal, copper, lead, zinc, tin, and aluminum Most of these have many uses in various forms. For our great industries today several metals mined in small amounts and used in only one or two ways are very important because of their value in alloy steels. Each one gives to steel special qualities greatly desired for different uses

**The Uses of Lead and Zinc.** Lead and zinc are remarkably useful metals. They are often produced together and both are used for paint pigments, foil, and collapsible tubes. But each has distinctive important uses The two chief uses of lead are for storage batteries and for underground or sub-

[1] *Numbers and letters refer to Selected References on pages 420–424*




PERCENTAGE OF WORLD OUTPUT BY COUNTRIES OF LEAD, ZINC, BAUXITE, AND NICKEL

FIG 257 What percentage of the world's output of lead do the leading three countries mine? Because zinc is shipped in the form of ore the percentages for the zinc bar represent smelter output Belgium, Poland France, Germany, and Great Britain mine little zinc but they smelt more than two-fifths of the world's total mostly from imported ores mined in Australia, Mexico, Burma, northern Africa, Italy, Spain, and Sweden The bauxite from the Guianas moves chiefly to the United States, and that from other areas to the manufacturing region of northwestern Europe

marine cables, each of which consumes one-fifth of the total amount used The paint industry takes much white lead, red lead, and litharge Lead is important for making printing type metal and ammunition Almost one-half of the American consumption of zinc goes to the galvanizing industry, in which a thin coating of zinc protects steel against rust More than one-fourth is used in the manufacture of brass

**Mining of Lead.** As with copper, the United States has the world's outstanding lead industry and has commercial control of most of the industry in Mexico. What part of the world output do the leading four countries mine (Fig 257)? Three districts mine most of the American lead (Fig 258). In eastern and southwestern Missouri are numerous signs of mining activity Although the topography is rough the districts lie near important manufacturing regions, a relationship accounting for the many small mines Considerable zinc is produced along with the lead All the remainder of the lead is mined in the Rocky Mountains Other minerals are usually mined with lead, especially silver As we should expect where conditions of transportation offer obstacles, the mines on the average far exceed in size those of Missouri

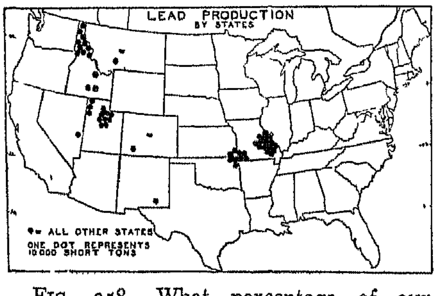



FIG 258 What percentage of our output do the leading four lead districts mine? Compare with Fig 260

After the concentration process, smelting lead is easy as compared with most other metals. The metal melts at a low temperature so it requires neither much fuel nor highly skilled labor In consequence smelting generally takes place in the mining district. When the lead occurs with other minerals, as it frequently does with zinc and silver, the metallurgy is more involved. For many years, the occurrence of lead with zinc made impossible the use of large quantities of

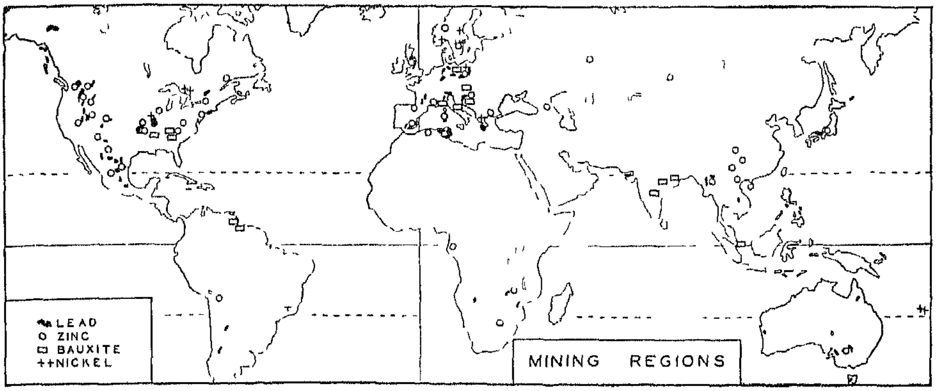



FIG 259 Many regions mine lead and zinc, but few mine bauxite and nickel The Sudbury district of Canada mines 90 per cent of the world's nickel Do the mining regions for these minerals lie for the most part in the great manufacturing regions of the world? From the graph page 312 pick out the important mining centers for the minerals The regions producing bauxite manufacture almost no aluminum Why? Australia, Mexico, northern Africa, Spain, Italy, Sweden, and Burma mine much zinc, but send the ores to east central North America and west central Europe for smelting and manufacture These mines are chiefly owned and operated by men from the importing countries

ore because the zinc interfered with smelting the lead Now the "selective flotation process" separates the two with great ease and as a result the world's reserves of both lead and zinc are much larger than formerly estimated

**The Mining of Zinc.** Like lead, zinc is mined in many regions and the United States has the largest output (Fig. 259) In international commerce zinc has more significance than lead This is due to the difficulty of smelting zinc Smelting zinc requires both great power and highly skilled labor Therefore, in contrast to lead, smelting usually is done not at the mine but near the centers of consumption. For example, Australia has a huge output of zinc ore but is credited with little zinc metal production Most of the ore goes to Belgium, a country mining little zinc, but with power resources and skilled laborers, so that it ranks next to the United States as a producer of zinc metals. It imports zinc ores from more than fifteen different countries. Spain, northern Africa, and Italy mine much zinc but because of lack of fuel, labor, and industrial establishments they send most of the ore to nearby foreign smelters.

In the United States almost one-half of this country's zinc, plus a large amount of lead, comes from the famous Joplin district. What three states share in this district (Fig. 260)? Next ranks the long productive New Jersey district, which produces only zinc. The Rocky Moun-

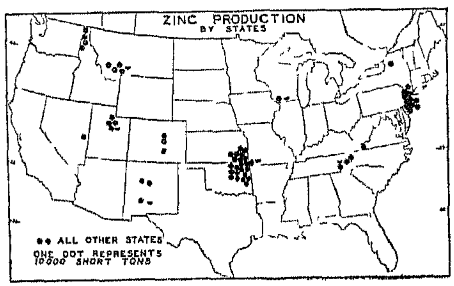



FIG 260. What part of our output do the leading two zinc districts mine?

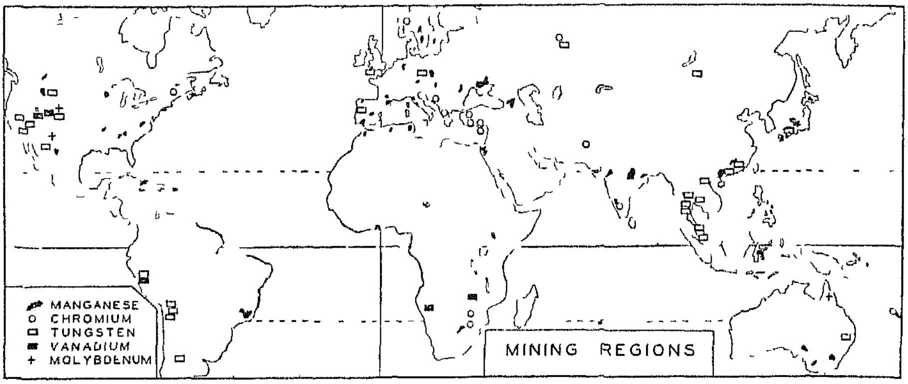


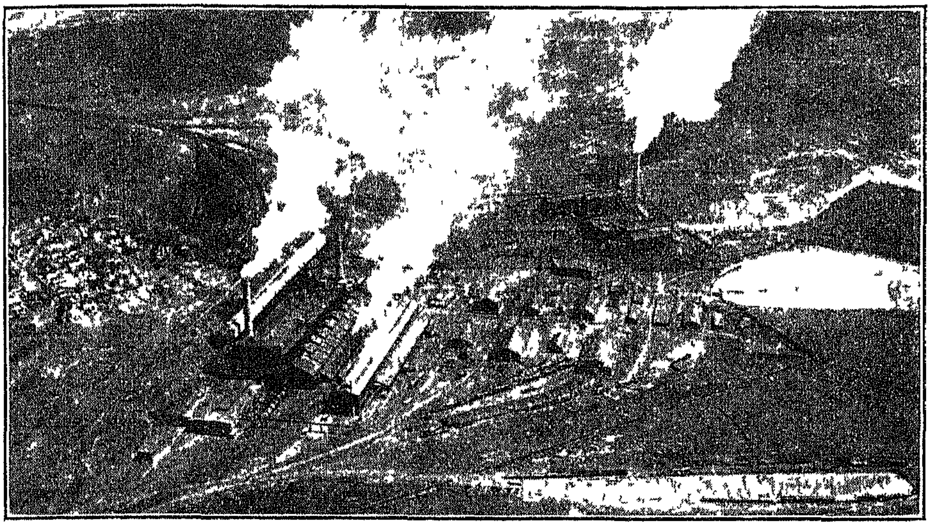

FIG 261 Many regions mine manganese, but very few produce vanadium Are most of the mining regions of alloy minerals in mountains or plains (pages 10–11)? In regions of dense or sparse population (pages 4–5)? In the regions that manufacture them (page 337)? From the graph on page 310 find the chief regions of production of each of these minerals

tain districts seem handicapped by great distance to market, but they can compete because the zinc is produced by efficient electrolytic methods as a by-product of silver, copper, and lead. Electrolytic zinc has high purity. The districts nearer the main manufacturing regions have not adopted the modern electrolytic apparatus, but distil the zinc in enormous retorts.

**Bauxite and Aluminum** Aluminum [2] costs several times as much per pound as copper, lead, or zinc but is only about one-third as dense, so that the prices per unit volume of copper and aluminum, for example, are more nearly comparable. Common clay contains a substantial percentage of aluminum oxide, but commercial ore of aluminum, called bauxite, has a larger content of aluminum oxide which can be extracted more economically than the aluminum from clay. For a long time the United States and France had the only bauxite industries but the increasing interest in aluminum led to developments in other countries What six countries now mine 94 per cent of the world's bauxite? The United States controls what per cent of the world's commercial production?

Bauxite mining regions produce little aluminum as a rule. The bauxite must first be refined (usually a chemical operation) to produce pure aluminum oxide, free from impurities such as iron and silicon. An aluminum reduction works requires expensive equipment and tremendous electric power in order to get metallic aluminum from the refined ore Thus in the United States, which manufactures more than one-third of the world's aluminum, there are only four aluminum reduction works. Each of

[2] Aluminum's most important characteristics are lightness and resistance to corrosion. In addition it is a good conductor of electricity, forms strong and useful alloys with other metals, and has numerous minor characteristics of considerable value. Transportation, in all branches of automobile, truck, railway, aircraft, and marine construction uses more aluminum than any other industry, but large quantities are used in architecture, furniture, household utensils, electrical conductors, and manifold other uses



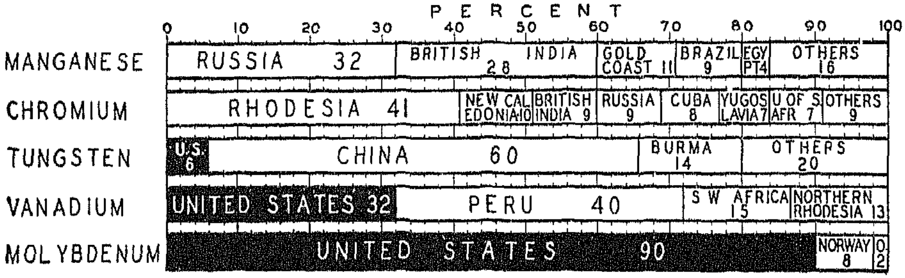
*Photographed by the Royal Canadian Air Force*

NICKEL MINES AND SMELTER, COPPERCLIFF, ONTARIO

FIG. 262 These great mines of Ontario, in a barren and infertile region, produce 90 per cent of the world's nickel and in addition quantities of copper, gold, and silver Some of the nickel from these great mines is refined in large plants at Port Colbourne on the northern shore of Lake Erie, where large quantities of coal may be obtained cheaply from the northern Appalachian field

these has been located near a source of cheap electric power. They are at Massena, New York, on the St. Lawrence River, at Niagara Falls, New York, Alcoa, Tennessee, and Badin, North Carolina What features of relief and rainfall led to the location of aluminum factories at those points? Canada's important industry depends on two plants, one drawing power from the St. Maurice River, the other from the Saguenay River In Europe most of the aluminum works are in mountainous districts of the Alps, in Savoy (France), Switzerland, Germany, Italy, and Austria. Norway and Scotland also have large and important reduction works. What factors account for the location of the aluminum factories of Europe?

**Mining of Alloy Metals.** The world mines a number of minor metals which, though rarely used by themselves, are used to give strength or other characteristics to steel and other alloys These minerals are found in many distant places Few of them comprise large industries, yet they are necessary in modern industries of giant size (Fig. 261). One of the commonest alloys is the one-cent coin in which copper is strengthened by alloying it with nickel Nickel is a common alloy, nickel-steel, and nickel-chromium-steel (stainless steel) are widely used in the automobile industry. Nickel-copper and nickel-silver alloys find many uses (Fig. 262). Vanadium added to steel gives strength and flexibility. Tungsten steel, one of the hardest materials known, is used for making "high-speed" cutting tools. Molybdenum steel also makes fine "high-speed"




PERCENTAGE OF THE WORLD OUTPUT BY COUNTRIES OF ALLOY MINERALS

FIG 263 The United States uses all these minerals as alloys of steel, but it produces considerable proportions of only two of them What percentage of the world's commercial control of production does it have (page 317)?

tools. Because of these special properties, man searches far and wide for the alloy minerals, and goes to great expense and endures hardships to mine them They are used in very small amounts compared to the amounts of the basic material in the alloy They emphasize in a striking way the power of iron and coal to attract other minerals for manufacture and use. None of the districts mining the alloy minerals uses much or any of them.

Vanadium serves as a good example. The world output is less than two thousand tons Two-fifths of the world's supply comes from Peru (Fig. 263). High in the Andes — more than three miles above sea level — lies the largest known deposit of vanadium ore The miners working at such a height endure severe hardships, but vanadium is so valuable that the men are willing to put up with them. Reducing the ore to obtain the vanadium requires high skill, coal for smelting, and expensive equipment Therefore, Peruvian workers prepare only a concentrate of the ore The mines belong to an American firm and all of the concentrate goes to the United States Europe obtains vanadium from the United States and from southern Africa, which ranks next to the mines in the highlands of Peru as a source of vanadium ores.

## EXERCISES

1. In amount mined, what are our important minerals?

2. Review the uses of copper and tin.

3 (*a*) What are the uses of lead? (*b*) Of zinc?

4. (*a*) What is an alloy mineral? (*b*) Are lead and zinc used as alloys? (*c*) Why does zinc have greater significance in international commerce than lead?

5. Answer the questions under Fig. 257 and Fig. 259.

6 Give four or more reasons to explain the location of the world's aluminum works

7 Why do people invest much money and endure hardships to produce the alloy minerals in distant lands?

8 Continue the table started in Chapter XXVIII.

9. Write to one of the large steel corporations of this country for booklets on different alloys of steel and list the kinds of steel.

## AN EXTRA LESSON

An extra hour may well be spent on the following two topics (1) Commercial control of mining different minerals, and (2) why most of the minerals are shipped to east central North America and west central Europe

COMMERCIAL CONTROL OF MINERAL PRODUCTION
(Figures in percentage of world total)

| *Silver* | *Potash* | *Sulphur* | *Tin* | *Lead* | *Zinc* | *Bauxite* |
|---|---|---|---|---|---|---|
| U S 66 | German 74 | U S 85 | British 32 | U S 47 | U. S 55 | U. S. 46 |
| British 22 | French 20 | Italian 11 | Chinese 22 | British 33 | British 20 | French 12 |
| Other 12 | Other 6 | Other 4 | Dutch 20 | German 6 | French 9 | German 10 |
| | | | Bolivian 17 | French 5 | German 8 | Italian 9 |
| | | | Other 9 | Other 9 | Other 8 | British 7 |
| | | | | | | Other 16 |

| *Nickel* | *Manganese* | *Chromium* | *Tungsten* | *Vanadium* | *Molybdenum* |
|---|---|---|---|---|---|
| British 50 | British 43 | British 65 | China 60 | U S 72 | U S. 90 |
| U. S. 40 | U. S. 20 | U. S. 15 | British 29 | British 28 | Norway 8 |
| French 6 | Russia 32 | Russia 9 | U. S. 7 | | Other 2 |
| Other 4 | Other 5 | Other 11 | Other 4 | | |

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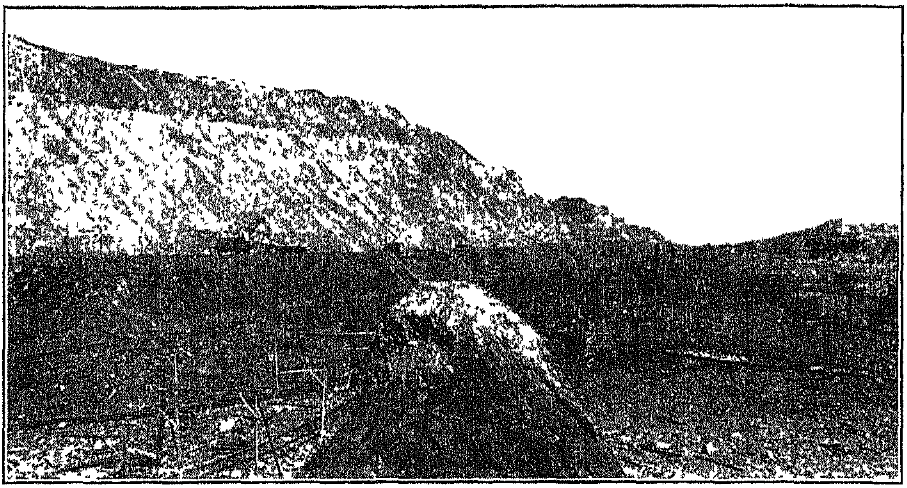
[3] Numbers and letters refer to Selected References on pages 420–424.



*Courtesy of Swedish State Railways*

FIG 264 MINING IRON ORE BY THE OPEN-PIT METHOD, NORTH OF THE ARCTIC CIRCLE AT KIRUNA, NORTHERN SWEDEN

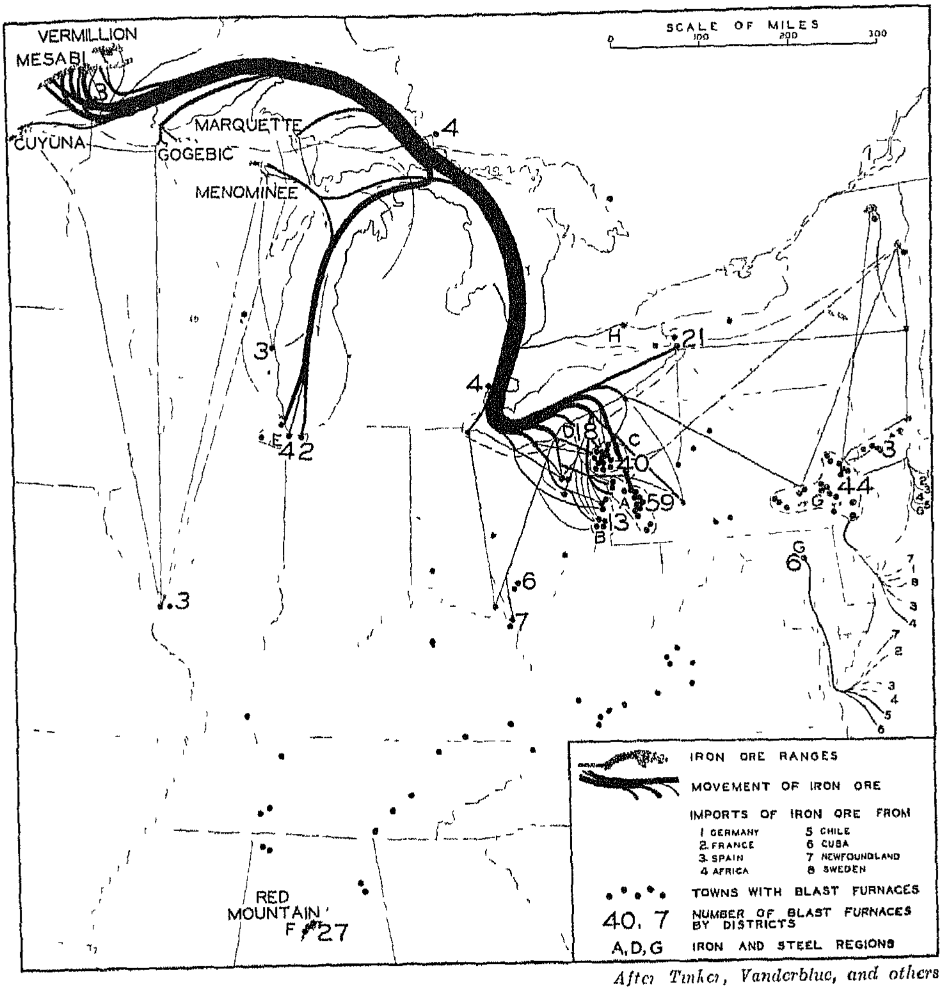
## CHAPTER XXX

# MINING IRON — THE MOST USEFUL OF METALS

**Mining in the Mesabi Range.** Fig. 264 shows the method of mining not only in the Mesabi Range but in other important regions About one-half of the iron ore of the world is mined by the open-pit method The Mesabi Range is one of the two most important iron mining fields in the world (Fig. 265) Its rank depends upon a number of conditions. The deposits of iron ore are enormous and of high grade They are covered by only a few feet of loose glacial drift, which is removed by huge steam shovels The ore is then scooped up and dumped into railway cars that come down into the pits. These mines have the disadvantage of being closed during the winter.

Point out other ranges in this region. Though some of these ranges were opened by pits, most of the ore now is mined by shafts and tunnels.

**Transporting the Iron Ore.** From the mines the railway cars move down grade to ports, where the ore drops by gravity from "hopper" cars into huge bins, thence through long chutes into the hold of lake freighters especially designed for the heavy bulky ore. A single freighter loads ten thousand tons of ore in an hour. The freighter made for lake navigation carries the ore cheaply to many lake ports where huge grab buckets unload a boat in five hours. Nearly all of the ore moves by boats to the lower lake ports. Many blast furnaces receive the ore direct from the freighter Those located inland get iron from ore cars owned by the steel companies. This cheap transportation is a great advantage for the steel companies although lake transportation has one disadvantage — the lakes are closed by ice for four months. Of course,

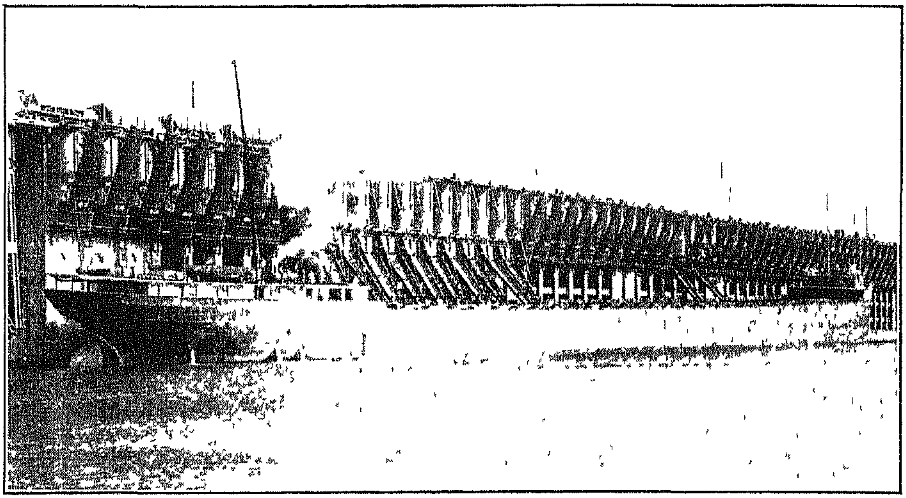



*After Tinker, Vanderblue, and others*

IRON MINING REGIONS, THE MOVEMENT OF ORE, AND BLAST FURNACES IN EAST CENTRAL NORTH AMERICA

FIG 265 Iron and steel regions A, Pittsburgh, B, upper Ohio Valley, C, Mahoning-Shenango Valleys, D, Lake Erie, E, Chicago-Gary; F, Alabama, G, Middle Atlantic; H, Ontario, Canada, I, Montreal The width of the line is in proportion to the ore movement

Note the movement of ore Why does it move almost entirely by water? From what foreign countries do we import ore? Contrast the iron mines of New York with the Mesabi Range Note the great concentration of blast furnaces in a few areas and the scattered furnaces of Virginia, Tennessee, and Kentucky These scattered furnaces represent an early development They are small, use local ore or scrap, and have a small output. One modern blast furnace at Gary handles as much material as seven of these small ones. What other handicaps do these small blast furnaces have? Many of them are being abandoned The large furnaces of the eastern seaboard district use iron from local mines, from the Lake Superior region, from foreign fields, and much scrap iron Being on or near the sea, they can get foreign ores cheaper than Mesabi ore because the ores of the Lake Superior region move from the mines by rail to lake ports, by boat to the lower lake ports, and thence by rail to the blast furnaces of the eastern district



*Courtesy of Childs Art Gallery and Cleveland Cliffs Iron Company*

LOADING A FREIGHTER, MARQUETTE, MICHIGAN

FIG 260 The ore, dropped from the bottom of the railway cars, slides into the bins and down the chutes into the hold of the vessel

companies depending on these ores store up enough during the summer to last through the winter (Fig 266)

**Mining Iron in Alabama.** The second great source of iron ore in the United States is the Birmingham district where there are three fields The chief one is Red Mountain In the long, narrow Red Mountain iron ore outcrops in a narrow band (p 344) On the side of the mountain the ore is taken out of many mines from tunnels (p 343) and moves down grade by rail only a short distance to the blast furnaces. The ore is high-grade and much of it has enough lime in it to be self-fluxing[1] The mines operate all the year, operations need not cease because of a heavy fall of snow or because freezing weather stops an important transportation link The mines and railways are owned by large steel companies of the district.

**Other Sources of Ore.** Many other regions in the United States mine iron ore but these mines are small and widely separated (Fig 267) Some

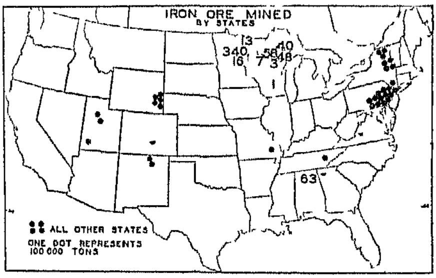
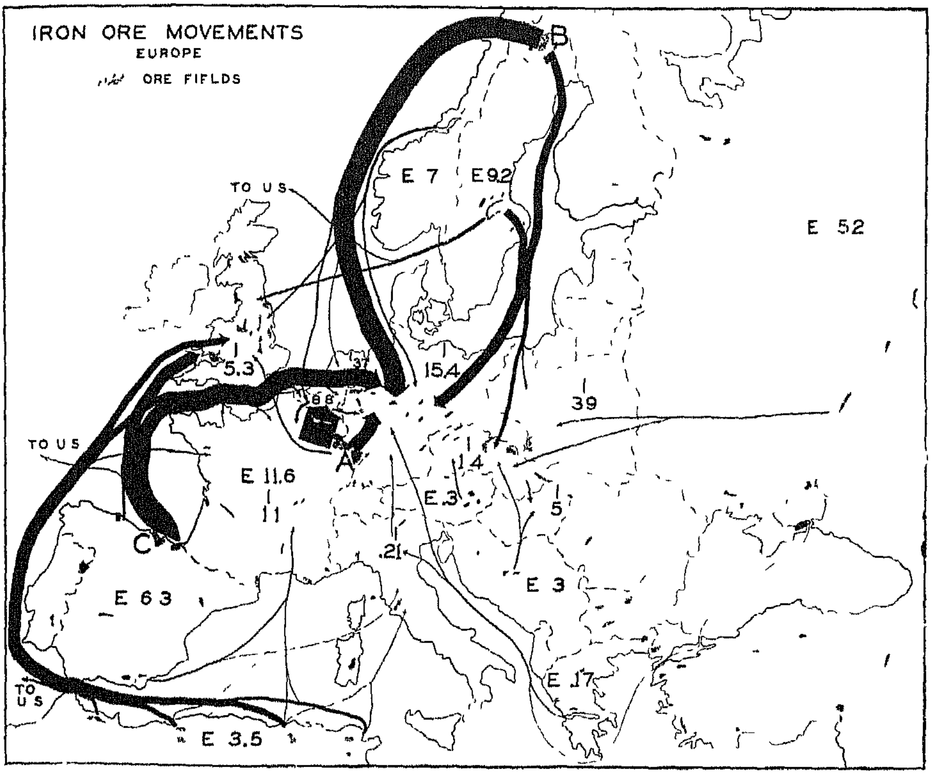



FIG 267 Although many districts in the United States mine iron ore, two produce most of the output The figures in Minnesota represent number of dots, each dot equals 100,000 tons of ore mined. What percentage of our iron ore does the Mesabi Range produce? The Lake Superior region? The *three ranges* of northern Michigan? The Birmingham, Alabama district? The ore mined in the United States totals 62,500,000 tons (recent three-year average) Compare this map with Fig 265

[1] In a blast furnace lime or limestone is used as a flux, when limestone melts it combines with the impurities in the coal and iron An ore that has much lime in it requires less limestone in the blast furnace.




ORE FIELDS AND THE MOVEMENT OF IRON ORE IN EUROPE

FIG. 268. A, Lorraine iron fields, B, fields of northern Sweden, C, fields of northern Spain. The numbers on the different countries indicate exports (E) and imports (I) in millions of tons. Note carefully the movement of the ore, compare with the movement of ore in the United States (page 319). Where does Great Britain obtain its imports of ore? Germany? Can you explain why Belgium ranks second as an ore importing country?

are open-pit and others are shaft mines. Some of them are very old, the ores now being largely used up. The ores vary greatly in quality. They supply small local furnaces.

Because iron ore is cheap in comparison with its weight, the United States imports about three million tons a year. This comes mainly from Chile, Cuba, Sweden, North Africa, and Spain (p. 319). It is smelted in the blast furnaces of the eastern seaboard. A small quantity also goes inland, as certain foreign ores have properties desirable for making special kinds of steel. We also export ore to Canada (p. 319).

**Mining and Transporting Iron Ore in Europe.** Nearly every country in Europe mines iron ore but a few produce most of it (Fig. 268). Among the large iron mining regions are the Lorraine field, which lies in France, Luxembourg, and Belgium, those of Great Britain, the fields of northern Sweden, and northern Spain. These fields mine seven-eighths of the iron ore of Europe.

The Lorraine field covers a large area and ranks with the Lake Superior

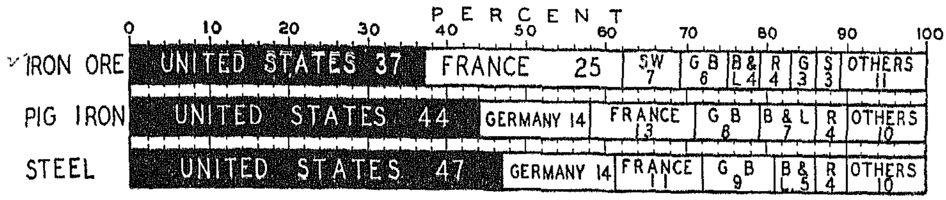
region It mines one-half of the ore of Europe The ore is of good quality carrying 35 to 40 per cent iron and enough lime to make it self-fluxing The ore beds occur in flat strata sixty to one hundred twenty feet thick from three hundred to seven hundred feet below the surface The ore is taken out through shafts and tunnels The mines may operate throughout the year Excellent railways cross the region Rivers and canals provide cheap transportation to many smelters in nearby districts The location of this region near steel districts is a great advantage The ore contains phosphorus and must be mixed with some imported ore The chief disadvantage of the field is that it is largely controlled by countries that lack sufficient supplies of coal to use the iron ore To what countries does the Lorraine ore move in large quantities?

Although the fields of Great Britain have been worked for a long time and the richer deposits have been used, they still produce millions of tons of ore The fields are small but the beds are nearly horizontal and have some outcrops in rolling country. However some mines are several hundred feet deep. In places the ore is quarried but the deposits are small and do not warrant the huge excavating methods of Mesabi or northern Spain The average iron content is less than 30 per cent but some runs as high as 50. Two fields produce 85 per cent of the British ores (p 339) The British fields have three advantages: there are several, they lie near coal and near the sea where imported ores may be deposited cheaply and whence steel products may be exported (p. 351). Most of the British ores contain sulphur and phosphorus and must be mixed with low phosphorus ores from Sweden and Spain Great Britain imports more than one-third of the ore it smelts From what countries does she obtain the ore?

The iron mines of northern Sweden resemble in several ways those of the great Mesabi Range of Minnesota. The ore is of high quality, averaging 60 per cent iron The deposits are enormous. The ore body lies near the surface, being covered only by a thin glacial drift Huge steam shovels lift the ore and dump it into railway cars It moves by rail either to an Atlantic port in western Norway or a Swedish port near the head of the Gulf of Bothnia The short rail haul is for the most part down grade Thence it moves by water to the large smelters in foreign countries. This region has some of the same handicaps as the Mesabi range At times during the winter the mines may be closed, but the port of Norway is open so that ore can move out all winter However the Gulf of Bothnia is closed by ice for four months To what regions does most of the ore move (p 321)?

Like Sweden, Spain mines much iron ore for foreign consumers Many districts produce iron but most of it comes from those of northern Spain near the shore of the Bay of Biscay Ores carrying 50 per cent iron and very little phosphorus are mined as at Mesabi or in northern Sweden Much British capital is engaged in the mining of iron here. Spain normally exports nine-tenths of the ore it mines. What countries are the chief importers of Spanish iron ore (p. 321)?

Point out other countries of Europe that produce considerable iron ore. Northern Africa has several mines pro-




PERCENTAGE BY COUNTRIES OF WORLD PRODUCTION OF IRON ORE, PIG IRON, AND STEEL

FIG 269 SW, Sweden, G B, Great Britain, B & L, Belgium and Luxembourg, R, Russia, G, Germany, and S, Spain East central North America and west central Europe (areas A and B, map page 284) smelt 95 per cent of the world's iron ore, pour nearly 90 per cent of the pig iron, and make 92 per cent of the steel

ducing iron ore for European furnaces The extensive deposits are controlled by European countries and capital The deposits, carrying 50 to 60 per cent iron and very little phosphorus, lie near the surface. They are near the sea which provides cheap transportation to Europe Which countries take much ore from northern Africa?

**The Wide Distribution of Iron Ore.** Iron is one of the most widely distributed minerals. Many regions mine iron (p. 284), but only a few have huge modern developments (Fig. 269) Some countries have huge reserves that haven't been touched For example, Brazil has some of the world's largest deposits which are high grade and lie near the surface. But they are four hundred miles inland and have poor transportation facilities Also Brazil has no coal and doesn't want to sell her iron ore to foreign countries Newfoundland, Cuba, and other areas have large, little-used deposits

**Where the World's Iron is Smelted and Manufactured.** In previous lessons we learned that most all other minerals mined in distant desert and mountainous regions moved to two large areas for manufacturing (refer to the map, p 284). Note the movement of iron ore on the maps, pp 319 and 321. Regions A and B smelt all the iron ore produced in them and enormous quantities that move in from the Lake Superior region, northern Sweden, northern Africa, and elsewhere Together these two regions smelt about 95 per cent of the world's iron ore Note on the map, p 284, that the world's chief coal mines lie in east central North America and west central Europe.

## EXERCISES

1. (*a*) List the advantages of the Mesabi Range for mining and transporting iron ore. (*b*) Of Red Mountain, at Birmingham, Alabama. (*c*) Answer the questions under Fig. 267. (*d*) What part of our ore do the Lake Superior and Birmingham regions produce? (*e*) Why do we import iron ore?

2. (*a*) Note the distribution of blast furnaces. (*b*) How do those of Virginia differ from those of Gary, Indiana? (*c*) What sources of iron do the furnaces of the eastern seaboard have? (*d*) Answer the questions under Fig 265. (*e*) From Fig. 268 make a list of the chief iron ore exporting countries and the amount they export. (*f*) Make a list of the chief importing countries and the amount they import.

3 (*a*) What advantages do the Lorraine fields have for mining and transporting ore? (*b*) What countries smelt

most of the Lorraine ore? (c) Why does Great Britain produce so much ore? (d) Why does she import ore and where does she obtain the imported ores? (e) Compare production and transportation of northern Swedish iron ore with those of Mesabi

4 Why does Spain export so much ore? Why does northern Africa export its iron ore?

5 Why doesn't Brazil use her iron ore?

6 Continue the table started in Chapter XXVIII

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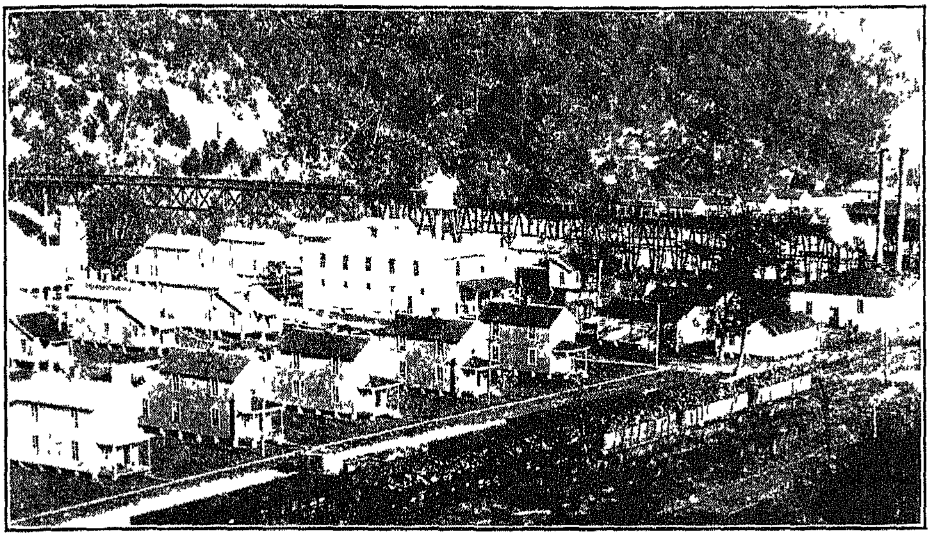
[2] Numbers and letters refer to Selected References on pages 420–424.



*Courtesy of* Coal Age, *New York*

COAL MINING TOWN, NORTHERN APPALACHIAN FIELD

FIG 270 In this deep valley note the homes of the miners, the cars loaded with coal, and the elevated railway that comes from the mouths of several coal mines on the side of the hill

## CHAPTER XXXI

# MINING COAL—THE MOST USEFUL OF FUELS

**A Gigantic Industry.** Every year the world produces about one and one-fourth billion tons of coal. The fact that this staggering weight must be mined, transported, and handled at the consuming point demonstrates the vital influence of coal in the modern world. The weight of half a dozen other leading world commodities does not equal that of coal. No other commodity figures in so many industries, perhaps no other would be so much missed if the supply were suddenly to disappear (Fig. 270). While such modern developments as electricity, petroleum, and natural gas have lessened our dependence on coal, nevertheless in large part they owe much of their activity to the power furnished by coal Most of the American electrical power is produced by coal.

Only in the last few centuries has coal been more than a curiosity Ancient travelers in the Orient sometimes spoke with wonder of stones that would burn. Even after Europe discovered that it had tremendous resources in coal, mining increased slowly because coal was regarded only as a possible source of heat. The modern coal industry really was born with the invention of the steam engine With it coal became supreme in industry as the great source of power developed by means of steam. Coal has been a tremendous factor in the development of world commerce in the last century and a half. Steamships make faster

voyages and carry larger loads than sailing vessels, while locomotives enable men to spread far into the great temperate plains of the world and bring products to the towns and seaports or to penetrate mountain fortresses for mineral resources. Great factories with coal as power and with supplies of raw materials and foodstuffs knit every thread of world commerce into an enormous fabric Today the world mines one hundred fifty times as much coal as it did one hundred years ago

Why is coal so important? Coal deposits of high quality are widely distributed (p 284). Easily mined in many places, coal does not require expensive smelting or refining It is inanimate and does not suffer with use. It does not deteriorate appreciably in transit or in storage, even in the open It may be used in any unit desired Not only does it raise steam, heat buildings, make coke, smelt minerals, and manufacture gas, but by distillation it yields hundreds of valuable substances These include in addition to gas and coke, ammonia, useful in refrigeration, explosives, and fertilizers, tar, from which innumerable aniline dyes result, coal-tar pitch, useful in surfacing roads, in making roofing, and in many other ways, crude light oils from which benzol and toluol, two very useful materials, are obtained.

## COAL MINING IN THE UNITED STATES

**Coal Fields and Coal Production.** Coal fields are widely distributed in the United States (Fig. 271). Name four areas that lack large deposits of bituminous coal Which of these lacks even extensive fields of brown coal? Two-thirds of our states mine coal but four-fifths of it comes from the leading five states Which are they? Also, one field produces all of our anthracite and three fields mine nearly nine-tenths of the bituminous coal

**The Importance of the Northern Appalachian Field.** The dominance of the northern Appalachian field in coal mining in the United States depends upon a number of conditions, one of the most important of which has to do with the nature of the coal seams In the Allegheny-Cumberland plateau the coal seams cover a large area and are relatively free of interbedded shale and slate The quantity

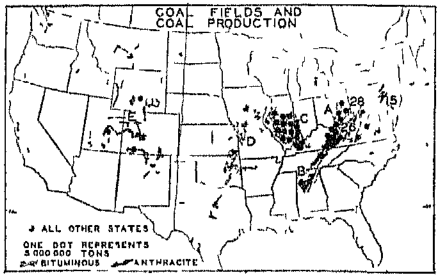
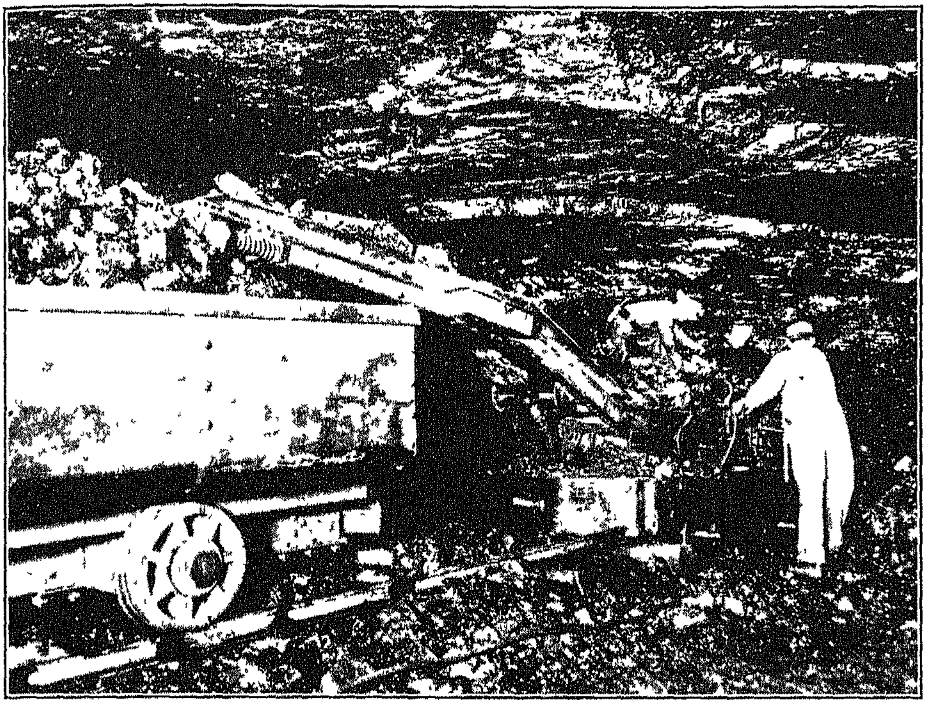



FIG 271 The coal fields A, Northern Appalachian; B, Southern Appalachian, C, Eastern interior, D, Western interior; E, Rocky Mountain In a recent year the United States produced 520,000,000 short tons of bituminous coal and 75,000,000 tons of anthracite The number "28" in western Pennsylvania stands for twenty-eight dots This means how many tons of bituminous coal? The Appalachian coal fields produce nearly three-fourths of our bituminous coals What percentage does the eastern interior field produce? The Rocky Mountain fields? To what industry is the small production of the Rocky Mountain fields especially valuable? What percentage do the leading three states mine? Note the lack of coal in the tier of states north of Pennsylvania and Indiana Some of the southern states, the Great Plains, and the states of the far west lack large deposits of bituminous coal, but they have extensive fields of lignite or brown coal Nearly all our anthracite is used for heating How does the location of the field favor this use?



*Courtesy of Coal Age, New York*

A NORTHERN APPALACHIAN COAL MINE

FIG 272 In this eight-foot seam, nearly level and continuous, a machine operated by two men is mining coal and elevating it onto a car that hauls it to the shaft by electricity.

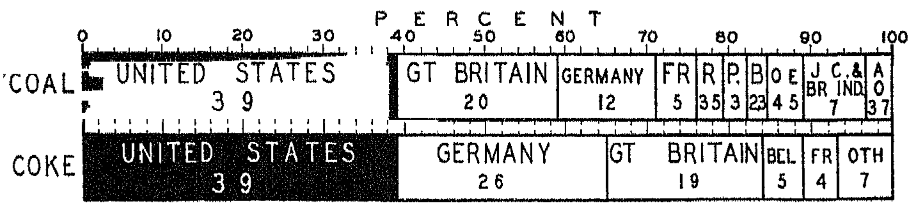
of coal is enormous. No field has more or better coal The fields have excellent coking, heating, and steaming coals and coals adapted to other special uses. Coal occurs in a number of seams, and while these are separated by rock, one shaft often gives entrance to several workable seams[1] The seams lie less than one thousand feet below the surface; in fact many streams have cut deep valleys into the plateau surface, exposing coal seams along the valley sides. These seams are entered by "drifts" or "addits" from the valley side and coal brought out on the level is let down easily to coal cars at the bottom of the valley or barges on the navigable streams. Where the mine is entered by shaft the seams lie near the surface, so that lifting the coal, pumping out water, and forcing in fresh air are not expensive. The seams are continuous and nearly horizontal for miles, making it possible to work a large area from each shallow shaft. The seams vary in thickness from a few inches to ten feet or more. In such seams the use of modern mining machinery is possible, and most of our coal is mined by machinery (Fig. 272). The rock overlying the seams has sufficient firmness to make unnecessary the use of large quantities of timber to hold up the roof of the mine

[1] The left half of the diagram on p. 344 illustrates the lay of the coal seams in a portion of the Appalachian field; the conditions in the northern Appalachian fields are quite similar. Count the slope coal mines and the shaft coal mines How many productive seams will each shaft reach?

Other conditions also favor coal mining in the northern Appalachian field The field is in and near regions of dense population, including many of our large manufacturing cities, and the great Atlantic ports are not far away It is near the great industrial region of Canada which produces little coal The rivers, the Great Lakes, the Atlantic, and a great railway network provide excellent transportation. Many strong mining companies, owning tracts of land and huge reserves of coal, employ the most modern methods on a huge scale Because of these excellent conditions, the cost of mining coal is much less than in most other large coal areas in spite of the high cost of American labor

**Eastern Interior Coal Field.** The eastern interior field produces nearly 17 per cent of our bituminous coal. The field is in a level farm country in contrast to the northern Appalachian field The seams lie at shallow depths In some places the coal is so near the surface that the overburden is stripped by huge machines and the coal taken from the pits by huge shovels The seams are nearly horizontal, continuous, and from two to seven feet thick. The coal does not make a high quality coke, though at times it is mixed with coal from the northern Appalachian field to make coke The coal has a firm structure so that it may be screened, sized, and shipped easily It is especially adapted for heating, which is fortunate because winters in the region are cold and wood is scarce Many railways, manufacturing establishments, cities, and the farm population of the Middle West [2] provide active markets for the coal.

**Southern Appalachian Field.** Compared to the other fields the southern Appalachian field is small in area and in production The coal seams are more tilted than in other fields, most of the mines are entered from the surface by "drifts" on the slope of the seams The coal is cheaply produced from fairly thick seams It makes excellent coke, for which much of it is used. Little is used for heating because of the short mild winters and abundance of wood for fuel Its distribution throughout the south for manufacturing and transportation purposes is favored by the development of Birmingham into one of the chief railway centers of the south and by canal and river transportation to the Gulf of Mexico




PERCENTAGE BY COUNTRIES OF WORLD COAL PRODUCTION AND COKE MANUFACTURE

FIG 273 Fr, France, R., Russia, B., Belgium; O E, other European countries East central North America and west central Europe mine nearly nine-tenths of the world's coal and manufacture nearly 95 per cent of the world's coke What countries in Asia together produce 7 per cent of the world's coal? Compare this graph with that on iron ore, pig iron, and steel (page 323)

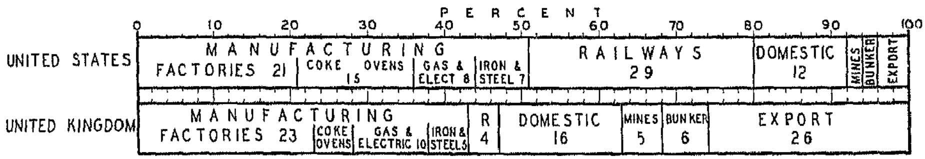
[2] Chicago is the greatest railway center in the world.

## COAL MINING IN EUROPE

Mining coal in Europe was a well-developed industry before it began in the United States. As late as 1875 Europe mined more than four-fifths of the world's supply Today many regions in Europe mine coal (p 344) and the continent produces more than half of the world's output (Fig 273)

**Great Britain.** Coal mining in Great Britain is carried on in many fields in three general regions: fields on the flanks of the Pennines, in the Scottish Lowlands, and in South Wales (p 339). Compared to the seams of the northern Appalachian field, the coal beds of Great Britain, in general, have several handicaps. The fields are smaller. The seams for the most part dip at considerable angles, they are broken by faults and offsets so that each shaft serves only a small area. The beds are far from the surface; many shafts extend down for two thousand feet and some for thirty-five hundred feet, in deep mines lifting coal, pumping out water, and forcing in fresh air are expensive. Except for a few fields the seams are thinner than those of the northern Appalachian field. In thin seams dipping at steep angles it is not feasible to use modern mining machinery. Less than half of Britain's coal is mined with machines Each miner in Great Britain is able to produce only one-fourth as much coal as the average miner in the United States This explains why it costs twice as much to mine a ton of coal in Great Britain as in the United States

The fields of Great Britain have several advantages The coals are bituminous and semi-anthracite, providing excellent coking, steaming, and heating coals The fields lie near iron mines, and are near excellent harbors. Rail and canal transportation are easily used to facilitate the use of coal and distribute it at low cost to any part of Great Britain. The large number of ships coming to Great Britain with raw materials and foodstuffs, carry millions of tons of coal to foreign markets In many respects coal is more important to Great Britain than to any other country. Although Great Britain has small reserves compared to ours, it mines only half as much as we do. Coal mining supports one-tenth of the entire population. Coal really is basic to Great Britain's manufacturing and commercial development (Fig. 274).




PERCENTAGE OF COAL USED IN THE UNITED STATES AND GREAT BRITAIN

FIG 274 The use of two-fifths to one-half of the coal for manufacturing indicates the importance of coal in the industrial life of the nation Explain why a much larger percentage of our coal is used for railways Give several reasons to explain why Great Britain exports more than one-fourth of its coal

**Germany.** Germany is the third great coal producing country of the world, if lignite be added she ranks second, for she produces in tonnage

more lignite than bituminous coal The lignite lies near the surface and is mined in huge open pits It is the basis of great electrical, chemical, and other industries But Germany's position as a coal mining and manufacturing nation depends equally on the great coal deposits of Westphalia, in western Germany The thick horizontal seams lie near the surface and can be worked by machinery More than half the coal of the country is mined by modern machines The field is in a region of dense population, an old manufacturing area covered by a network of canals and railways The field has one-half of all the known coal reserves of the mainland of Europe What iron field lies near?

**Great Coal Mining Regions and their Significance.** The map on p 384 shows that many regions mine coal. Most of the countries of Europe produce some coal but the chief ones, in addition to Great Britain and Germany, are France, Russia, Poland, Belgium, and Czechoslovakia In Asia the mines of Japan, China, and British India in each case produce about as much as Belgium The three continents of the Southern Hemisphere produce only 2 per cent of the world's output

The great coal mines lie in regions A and B (east central North America and west central Europe) Together they produce nearly nine-tenths of the world's coal The maps on p 319 and p 321 show that large quantities of iron ore move into these regions Coal is the chief source of power, iron ore is the great basic metal Both are used in huge quantities while the alloy minerals are used in small quantities Together coal and iron have the power to attract to them from distant desert, jungle, or mountain areas all other minerals and to foster great manufacturing industries and commercial enterprises.

## EXERCISES

1. List several reasons to explain why coal is so important

2 (*a*) Answer the questions under Fig 271 (*b*) What four regions of the United States have little or no bituminous coal? (*c*) List all the factors that account for the importance of the northern Appalachian coal field under two headings. (1) those that relate to the character of the coal seams and (2) other factors

2. (*a*) In what ways is the eastern interior field like the northern Appalachian field? (*b*) Different? (*c*) The southern Appalachian field?

3 (*a*) What handicaps have the coal fields of Great Britain? (*b*) What advantages?

4. (*a*) Contrast coal mining in Germany with that in Great Britain (*b*) Why is lignite mining so important in Germany?

5. Complete the table started in Chapter XXVIII

6 What significance is attached to the fact that east central North America and west central Europe mine nearly nine-tenths of the world's coal and smelt 95 per cent of the world's iron ore?

## SUBJECT FOR DEBATE

Resolved: "That the coal industry should be under Federal control."

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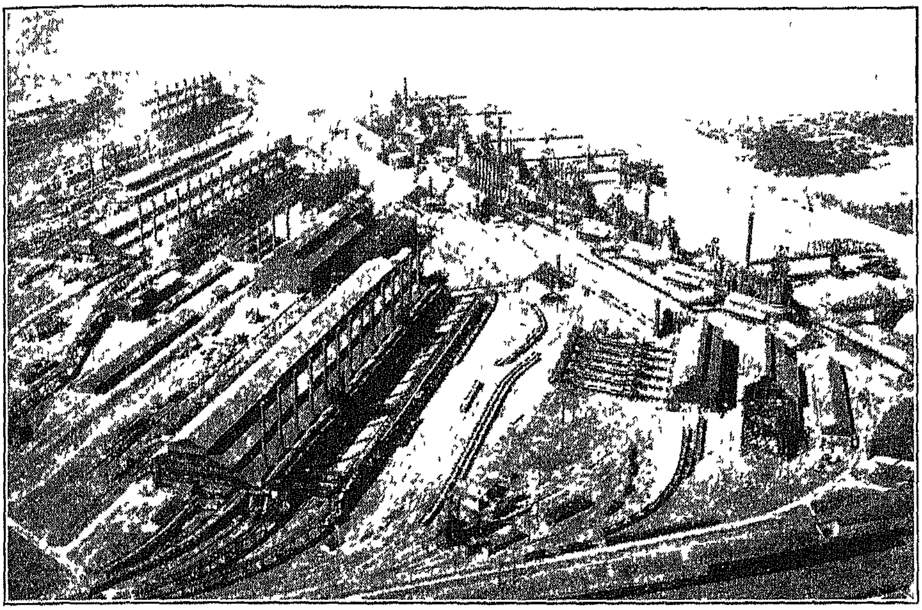
[3] Numbers and letters refer to Selected References on pages 420–424
[4] Rather difficult reading

# PART VII

# MANUFACTURING AND TRADE



*Courtesy of Chicago Aerial Survey Company*

AERIAL VIEW OF INDIANA STEEL COMPANY, GARY, INDIANA

FIG. 275. The features of this huge plant from right to left. A long pile of crushed limestone, the ship channel, ore unloading cranes, docks with piles of iron ore and limestone, long row of blast furnaces, rows of steel rolling mills, and railway yards. To the extreme right near the end of the channel just off the picture is a huge coke by-product plant and off of the picture to the extreme left are sheet mills, tube mills, and a tin plate mill. This huge industrial layout draws ore, coal, and limestone for hundreds of miles and alloys from distant mountains and desert regions. Many plants of this type are essential to our steel machine age.

## CHAPTER XXXII

# THE NATURE OF MODERN MANUFACTURING

Manufacturing is one of the most necessary activities of man. Hundreds of millions of people depend upon it for food, shelter, clothing, tools, and luxuries. This is true not only of the peoples who live in the most highly developed regions, but also of those who inhabit tropical forests or remote mountain districts. Manufacturing is closely related to other occupations, since it depends on them for raw materials for the factories, foodstuffs for the workers, and markets for manufactured articles (Fig. 275).

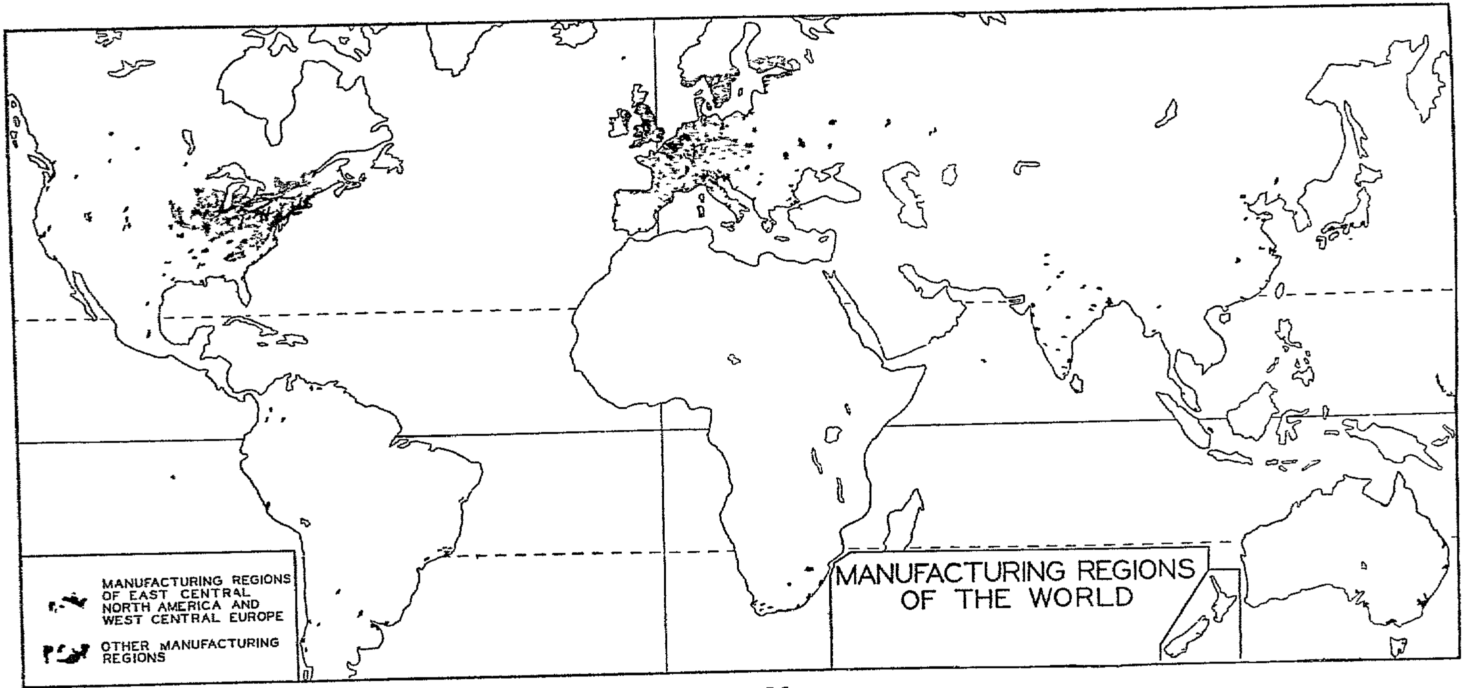
**Types of Manufacturing.** In the order of development or complexity there are three major types of manufacturing: the primitive or household type, the workshop or community type, and the complex modern factory type.

The primitive types include those products made by hand in the home

from local raw materials and used chiefly in the home. In the advance of primitive peoples this is the first type of manufacturing to develop. As people become more highly civilized, the household type decreases in importance. Among primitive and poor peoples it still supplies most of the manufactured products consumed. In the Andes of South America, for example, many Indians still prepare all their food from crops and animals. They manufacture their clothing, bedding, and shoes from the wool and pelts of sheep, llamas, and alpacas. They make tools, implements, containers, and utensils from the little wood available, a few minerals, and skins and bones of animals. They build homes of adobe, stone, and thatch. They make musical instruments of reeds and skins of animals. Other people who carry on this type include forest Indians and Negroes of the tropics, nomadic herders of central Asia, reindeer herders of northern Eurasia, and the Eskimo. Also millions of poor people of southeastern Asia make by hand in the home most of the things they eat, wear, and use. To this type belongs the making of lace by women as they tend flocks of sheep and goats in the highlands of Europe, the making of lace by the country girl or woman of Puerto Rico; the weaving of linen in the home in Russia, the making of toys in Swiss and Czechoslovakian homes, the canning of fruits and vegetables in the home, and the making of hair nets by Chinese girls.

The workshop or community type is also widespread, and many regions that have the primitive type also have this type. In the Andes of Peru a community weaver spends all of his time weaving the cloth for the entire village. Other Indians make shoes, and still others make crude implements. The men who are particularly apt in certain work specialize in one industry. On a larger scale the workshop is very important in Chinese manufacturing. A shop may include as many as one hundred workers, many specializing on one type of work in the shop. The materials used are principally local, the power is chiefly hand power, but the goods may be consumed in distant regions. Chinese examples of the workshop type include porcelain, leather, furs, rugs, firecrackers, rattan furniture, mats, and Mah Jongg sets. In a similar way tobacco leaves are graded and packed in a workshop in Cuba, while in others they are manufactured into cigars. Another type of community industry is illustrated in this country by the local baker, printer, ice cream manufacturer, and carpenters and builders. In these cases raw materials may come from distant regions but the market may be largely local.

The distribution of the complex modern factory type of manufacturing is shown in Fig. 276. The most striking fact shown by the map is that most of the world takes little part in making the complex articles which constitute the chief element in modern manufacturing. Tropical lowlands have little modern manufacturing; what they do have is of a rather simple type, like drying coffee and cacao, coagulating sap from trees, extracting fibers from plants, extracting oil from nuts, refining sugar, and smelting tin. In the regions that are always cold (pp. 14–15) there is far less modern manufacturing than in the tropics. Nearly all the modern manufacturing



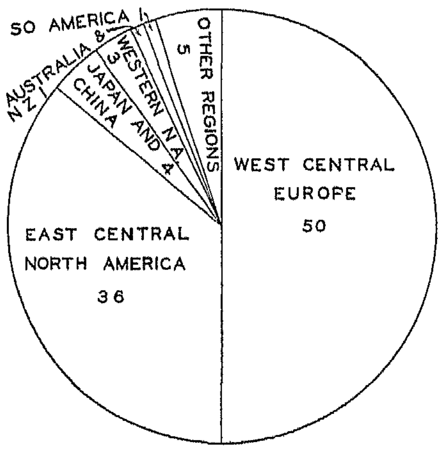

REGIONS OF MODERN MANUFACTURING

FIG 276 A surprisingly small amount of manufacturing is carried on either in tropical lowlands or in regions that are always cold We have learned that tropical regions yield many farm, forest, and mine products but for the most part these are manufactured in other regions Why? Because the heat of the tropics makes factory work intolerable, because these tropical regions have very little coal and iron; and because the people are mostly of backward races with little or no capital, and often plagued by tropical diseases Can you give reasons why manufacturing is not carried on in the regions that are always cold? The two chief regions produce what part of the world's coal (page 328), coke (page 328), iron ore (page 323), pig iron (page 323), and steel (page 323)? Do these figures help explain why raw materials and foodstuffs of many kinds move from all the world to these two great areas? Other conditions that favor manufacturing here include a healthy invigorating climate, energetic people, an early industrial start, transportation, and capital

of the world is carried on in eight regions east central North America, west central Europe, southeastern Asia, western North America, eastern South America, southern Africa, southeastern Australia, and middle Chile However, four-fifths of the complex articles of the world are made in the two leading regions The position of these two areas depends not upon a single factor, such as invigorating climate or easily produced high-grade coal, it depends upon a favorable combination of a number of factors not possessed to the same extent by any other large area

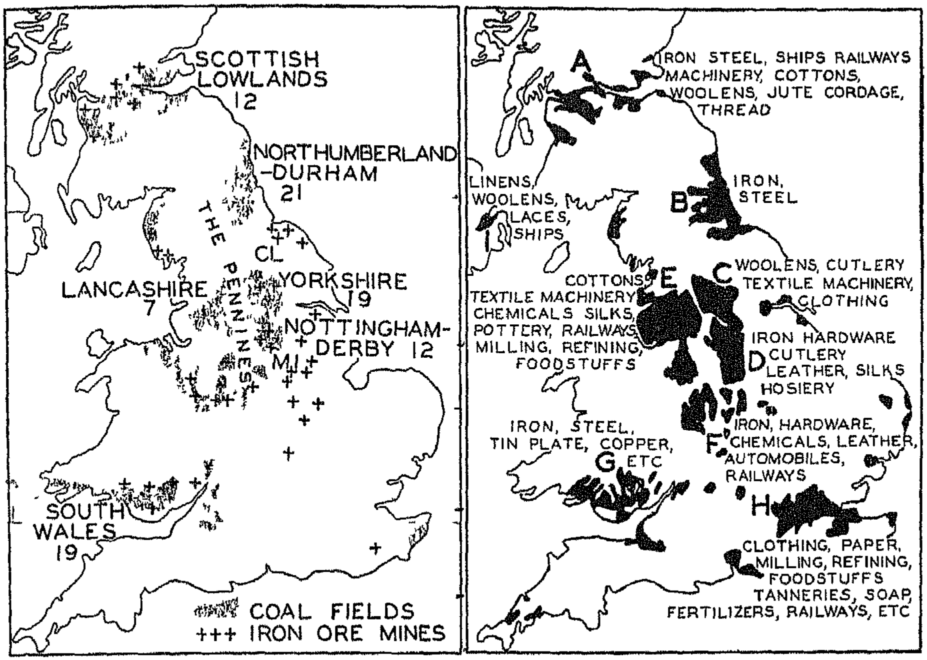
Before the invention of the water wheel, the steam engine, machines, and the use of coal, all manufacturing was either of the household or of the community type. The chief regions of manufacturing then were those of highly developed civilizations and dense populations — southeastern Asia and the Mediterranean region. West central Europe and eastern United States developed the two types of industries, but later were stimulated to invent machinery. This brought about the industrial revolution and modern manufacturing. It is interesting to note that these areas have the advantage of invigorating climate, energetic races, usually peaceful conditions, easily worked forests, easily developed water-power sites, and the close association of coal and iron. In other words, these regions have the essentials of great modern industrial development and in them have been made and applied most of our modern inventions.

**Power.** Modern manufacturing has several essentials, but *the possession and the use* of sources of mechanical power are perhaps the leading factors in a nation's manufacturing development The three great sources of power are coal, oil, and water power Coal supplies nearly three-fourths of the mechanical power of the world Oil is increasing in importance as we learn more about using it Ranking third, water power is very important in areas that lack coal, such as New England, eastern Canada, Switzerland, Sweden, and Brazil. The countries that mine coal, refine petroleum and use water power are the great manufacturing nations Every region that has developed great industries has made use of mechanical power Figure 277 clearly illustrates the relation between the use of power and the chief manufacturing regions




Power Used in Manufacturing by Different Regions in Percentage of World Total

Fig 277. The power used in manufacturing includes coal, petroleum, and water power, or electricity derived from them. The two great manufacturing regions use 86 per cent of all the power employed in manufacturing. The chief areas included in other regions are eastern Europe, Africa, and India South America, Africa, and Australia use less than 3 per cent of the power employed in manufacturing in the world




Coal, Iron Ore, and Manufacturing Districts of Great Britain

Fig. 278 The figures under the names of the important coal fields indicate the percentage of Great Britain's coal mined by each field.

Note the location of the iron mines. Two iron fields. (Cl.) Cleveland fields of North Yorkshire and the (Mi.) Midland fields on the eastern flank of the Pennines produce 85 per cent of the British iron ore, the Midland fields alone produce two-thirds. Note the relation of coal, iron, location on the sea, and manufacturing districts.

Manufacturing districts. A, Scottish Lowlands, B, Northeast England. Newcastle, C, Yorkshire, D, Nottingham-Derby; E. Lancashire, F, South end of the Pennines. Birmingham, G, South Wales; H, Thames estuary. Metropolitan London, I, North Ireland. Belfast.

The Thames estuary and North Ireland districts do not lie on or near coal fields, but they obtain coal cheaply by boat. The Thames estuary has a great variety of manufactures, related to its functions as a great port. It refines sugar, petroleum, vegetable oils; saws lumber, tans leather, mills wheat, prepares tea, coffee, and cacao, makes clothing, paper, fertilizer, soap, rubber goods, cordage, furniture, railway supplies, etc. The plants receive the raw material direct from ocean vessels. North Ireland draws coal and steel from the Scottish Lowlands and Lancashire nearby.

**Raw Materials.** The nations that have power are able to assemble raw materials and to fabricate our great machines which are made of iron, alloy minerals, and wood. Used in huge quantities as raw materials, coal and iron give rise to some of our greatest industries. Into or near to the coal- and iron-using regions move all the alloy minerals and many other raw materials needed in manufacturing (Fig. 278). Thus coal and iron are primary causes for industrial development in many districts of the north temperate zone. What do the maps on the pages listed show with reference to the relation of coal, iron, other minerals and manufacturing: pp. 326, 319, 321, 339, 284, and 337?

**Labor.** A single large automobile

factory today may have twenty thousand laborers, working at a variety of tasks. Supplying such a plant with men is a big job In all of our factories great and small energetic, intelligent, skilled, and healthy workers are required Compare the population map (pp 4–5) with that of manufacturing regions (p 337) Do regions of sparse populations contain great industrial districts? West central Europe and east central North America have many people per square mile, there is little land per man. Since there is prospect of regular work laborers of a high type are anxious to live in the large factory areas On the other hand, the most densely settled region of the world, southeastern Asia, only recently has developed modern manufacturing because of little capital, ancestor worship, the difficulties of producing coal and iron, poor transportation facilities (p 18), and the low buying power of most of the people

**Transportation.** A glance at the figure on p. 359 will emphasize the significance of a well-developed system of waterways, railways, and highways to a modern factory. The automobile industry requires materials in huge quantities from all over the world. They move into the factory in a continuous stream and come out in a line of cars that utilize rail, water, and road transport to market. Our other great plants are no less dependent on transportation. The large movement of ocean freight is into and out of the two leading manufacturing regions (p. 402) and these two areas have the chief railway networks of the world (pp. 404–405)

**Stimulating Climate.** One of the chief reasons for the development of manufacturing in west central Europe and east central North America is that the climate changes frequently Rainfall, temperatures, winds, sunshine, and humidity change from day to day and from season to season These frequent changes are stimulating. People are able to work harder and with less discomfort than in more humid and hotter regions The long winter season, when foodstuffs cannot be produced, has forced the people to store up food This has engendered thrift so that people have also learned to work and save money for future use

**Capital.** One of the chief differences between the more elementary stages of manufacturing and the factory is the capital or money needed The factory can develop only where the people accumulate money, spend it for necessities, and are willing to invest the surplus in great enterprises. In a land like China, where the poor people are unable to accumulate a surplus and where famine frequently strikes, modern factories are slow in developing. The two great manufacturing regions of the world have millions of energetic factory workers who spend freely, place money in savings accounts, and even invest it in the stocks and bonds of large corporations These two areas control much of the capital of the world.

**Markets.** Where there are millions of workers with money to spend and invest and where the standards of living are high, there we find the principal consuming areas of manufactured articles Thus the two great manufacturing regions are the chief markets for their wares. For example, more than 90 per cent of the automobiles of the world are registered in the United States, Canada, and the countries of

Europe. We have learned that though these regions produce much food, they buy from many regions enormous quantities of cereals, fruits, meats, and dairy products to feed the industrial workers. To pay for these, the regions market manufactured wares in many parts of the world.

## EXERCISES

1. (*a*) What are the three types of manufacturing? (*b*) From p. 68 make a list of the articles that the Kirghiz tribes make giving the raw material in each case. (*c*) Do the same for the Eskimo. (*d*) What relation do the regions with this type of manufacturing have to the regions shown on the map on p. 337? (*e*) Show how the American pioneer settler furnishes a good example of the primitive type.

2. What are the chief differences between the primitive or household type and the workshop or community type of manufacturing?

3. (*a*) Which large portions of the earth have little modern manufacturing? (*b*) Why is there little manufacturing in the tropics? (*c*) In the regions that are always cold? (*d*) In the grazing lands of central Asia?

4. List several conditions to explain why the leading two manufacturing areas produce about four-fifths of the complex articles of the world.

5. (*a*) What conditions in Argentina retard great manufacturing development? (Use several maps.) (*b*) Explain why South America, Africa, and Australia use less than 3 per cent of the power employed in manufacturing in the world.

## READINGS [1]

"Development of the Factory System" — 77, pp. 106–119, 94, pp. 229–232.

"Manufacturing in the United States" — B, XXVII (1928), 207–219; 82, pp. 37–57.

"Manufacturing England" — 2, IV, Chapter VI.

"Fuel and Power" — 95, Chapter XII.

"The Fundamentals of Manufacture" — 19, pp. 179–190; 15, Chapter XVIII.

## TOPICS FOR INVESTIGATION AND REPORT

"A Nation's Water Power" — A, III (1927), 434–446.

"Primitive and Community Industries in China" — A, V (1929), 1–10.

1 Numbers and letters refer to Selected References on pages 420–424.

# CHAPTER XXXIII

## THE IRON AND STEEL INDUSTRY — A BASIC INDUSTRY

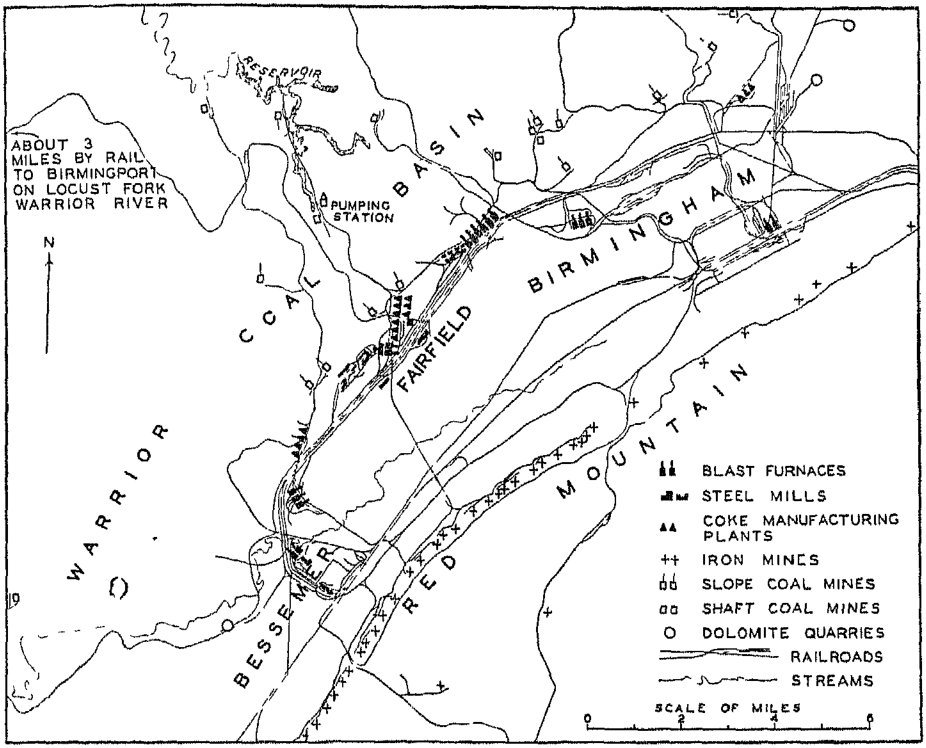
### § 1 — NORTH AMERICA

A great iron and steel industry involves a number of processes or steps mining and transporting iron ore, coal or coke, and limestone to the blast furnace, refining iron ore, converting pig iron or molten iron and alloy minerals into steel, making steel rails, sheets, pipes, bars, and many other products; and marketing these for use in these forms or as raw materials in automobile, locomotive, implement, machine, or other factories. In previous chapters we studied the mining and transportation of coal, iron ore, and alloy minerals Now we are interested in what happens to iron ore in the blast furnace and why certain regions have developed great steel and related industries

**Iron Ore in the Blast Furnace.** The blast furnace separates iron from oxygen and other impurities in iron ore. This process is accomplished as follows iron ore, coke, and limestone are dumped in at the top of the blast furnace in layers or mixed together. A blast of air, heated to 3000 degrees Fahrenheit is blown in at the bottom of the blast furnace under a pressure of ten or more pounds to the square inch. This blast causes the ore, coke, and limestone to become white hot and melt. The iron separates from the oxygen and other impurities and, because it is heavy, sinks to the bottom of the furnace The limestone and impurities in the ore combine in a slag which floats on top of the molten iron. The oxygen and gasses developed from the burning coke rise to the top and are drawn off to heat the blast of air or to generate steam to run the machinery or to generate electricity. Near the bottom of the furnace molten iron is drawn out through a hole and run into molds to form pig iron or into massive ladles that move on railway cars or on overhead tracks to the brick-lined converters where the molten iron is mixed with alloys and purified to form steel. The slag is drawn off at a higher level and dumped to cool, later it is made into cement or fertilizers. Because of the great heat of the blast air, the furnaces, and the converters, much water is required to protect the furnaces and machinery so that every furnace has a water-cooling system. That is why every huge blast furnace of the world is located on or near a lake, river, or reservoir. The blast furnaces that are located near iron ore, coking coal, and limestone have a big advantage over those that have to haul these heavy materials a considerable distance.

**The Alabama Iron and Steel Region.** The Birmingham region of Alabama has very favorable conditions for the manufacture of iron and steel (Fig. 279).

Under what conditions is iron ore



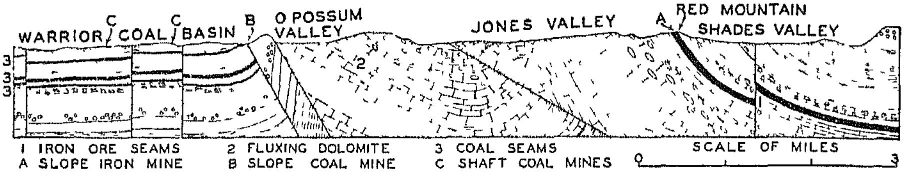

THE ALABAMA IRON AND STEEL DISTRICT

FIG 279. The assembling and manufacturing costs in this region are the lowest in America Why? Because iron ore, coking coal, and dolomite lie within fifteen miles of one another and of the coke plants, furnaces, and steel mills Explain the distribution of iron mines, slope coal mines, blast furnaces, steel mills, and groups of railway lines How many iron mines on Red Mountain?

mined in Red Mountain (p. 320)? Red Mountain supplies nearly 90 per cent of the ore used in the Alabama district. The ore seam outcrops along the top of Red Mountain for more than twenty-five miles and is entered by slope mines. The seam varies in thickness from fifteen to twenty-two feet, the ore averages 30 to 40 per cent iron, and one-fourth of it is self-fluxing. Machinery is used to break out the ore Mules haul it to the main slope of the seam, and cables take it to the top of the crushers whence it drops into railway cars bound for the furnace.

Only a few miles to the west lies the Warrior coal basin (Fig 280). It covers a large area and contains more than half of the coal lands of Alabama. The upper and middle seams are nearly horizontal, uniform in thickness from three to seven feet, fairly continuous, not very deep, and contain high-grade coking coal and only a small amount of impurities. Slope mines on the eastern margin produce most of the coal. Where are the slope mines with reference to the by-product coke plants and the steel plants? How many shaft mines do you find?

Between Red Mountain and the slope coal mines lie the dolomite quarries which produce the fluxing mate-




DIAGRAMMATIC CROSS-SECTION OF IRON AND COAL SEAMS AT BIRMINGHAM

FIG 280 The close juxtaposition of coal, iron, and dolomite and the broad flat O'Possum and Jones valleys for the location of steel plants favor this industry The slope coal and iron mines are on the sides of mountains and face the valleys How far is it from Red Mountain to O'Possum Valley? From the slope coal mines to O'Possum Valley?

rial for the blast furnace The dolomite outcrops at the surface in the valleys and is produced and hauled a short distance cheaply. Dolomite is an excellent flux because it is pure, has great fluxing power, and makes the slag flow easily

The ease with which these three materials may be mined and brought together gives this region the lowest assembly costs in America

This steel district is able easily to bring in the raw materials and ship the finished products to market. The iron ore goes only a few miles down grade on railways, many of which are elevated above roads and cross railway tracks so that there is no interruption in ore movement day or night. Coal is mined almost at the door of the coke plants Some companies own the railways that feed the furnaces In addition more main-line railways enter this district than any other southern manufacturing center A belt-line railway connects the main and local lines Moreover, the district is only twenty miles by rail from Birmingport and the Federal Barge line which gives all-year water transportation to Mobile and the Gulf of Mexico

The district itself is the chief market, taking more than half of the pig iron and steel, but it can compete with other regions in nearly one-third the area of the United States, where live about one-third of our people (Fig 281) As the district has all-year water transportation, it is well situated for foreign trade, especially to Hispanic America and Asia.

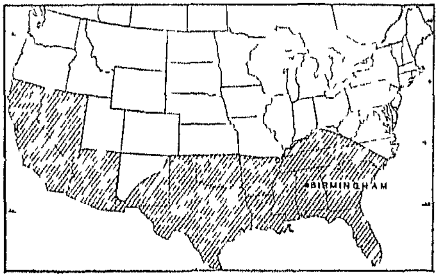



FIG 281 The ruled area shows the area of the United States in which the freight rates from the Alabama region are less than, or no more than, those from Pittsburgh and Chicago on bars, plates, and structural steel It represents a great market area

Much colored and white labor is available Labor costs are lower because clothing, fuel, and rent are less than in the colder climates of Pittsburgh or Chicago and also the competition for labor is less. Negroes do most of the mining and the heavy work at the blast furnaces and coke plants.

In the huge plants much industrial water is necessary It is obtained cheaply from the streams and a huge

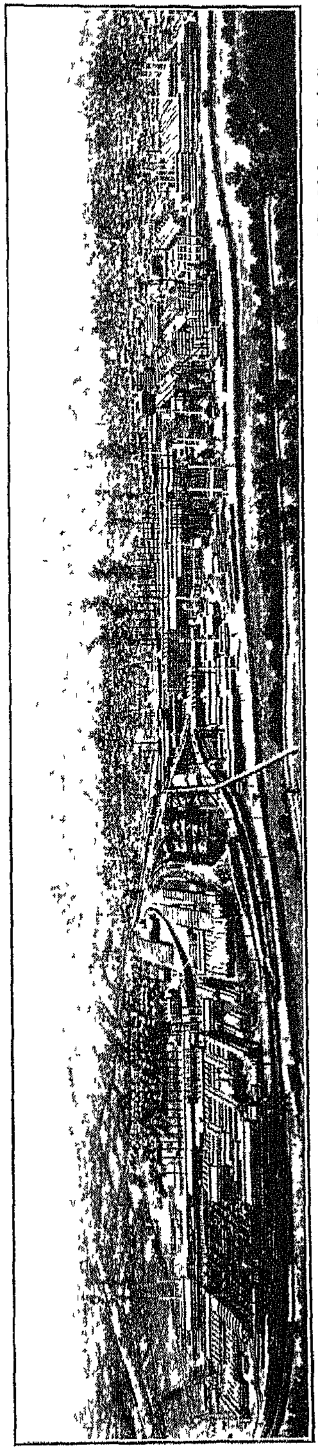
reservoir a short distance to the northwest of the district (p 343)

In the broad flat valleys the companies have ample room for their long single-story buildings in a row from the blast furnace to the finishing mills (p 345)

Because of all of these advantages the Alabama region has the lowest assembly and manufacturing costs of any iron and steel region in North America This region makes many products pig iron, gas and other by-products, fertilizer, castings, steel rails, structural steel pipes, tanks, cotton-ties and hoops, tin plate, wire, nails, bolts, cars, and rough steel sheets, billets, and rods for other manufacturing industries.

**The Pittsburgh, Upper Ohio Valley, and Mahoning-Shenango Valley Districts.** The region embracing these three districts is the leading iron and steel region of the world. It has many advantages for a great industry fairly cheap transportation of high-grade iron from the northern ore fields, large quantities of high-grade coking coal nearby, a good supply of industrial water, an early start, a large supply of good labor, and excellent valley rail and river transportation. Barges take coal cheaply to the door of the plants and, except for district C, barges carry a great deal of steel down the Ohio. As a result the great manufacturing centers of east central North America have developed in this region. Thousands of plants take iron and steel products in the region and in the cities of the seaboard and Middle West.

Compared to the Alabama region, this one has certain disadvantages. Limestone must be brought for about one hundred miles by rail from the



*Courtesy of Bethlehem Steel Company*

BETHLEHEM PLANT OF BETHLEHEM STEEL COMPANY

FIG 282. This plant is located in a narrow valley like those of western Pennsylvania Note the river the homes of the workers, and the hill beyond.

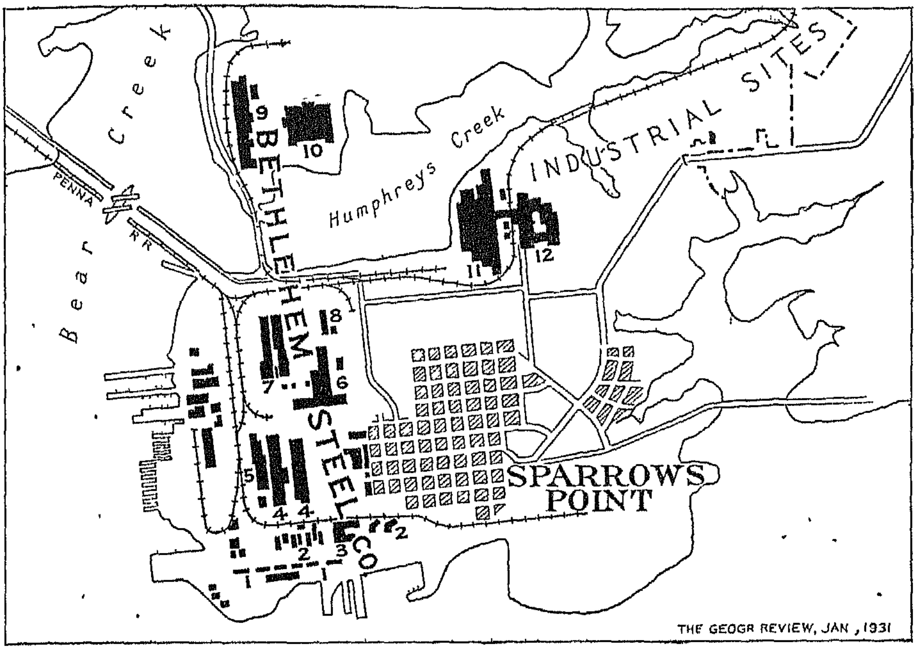
mountains east of the region or from northern Ohio Iron ore comes by rail nearly one hundred fifty miles from the Lake Erie ports, but many companies own the railways and have special ore cars easily handled Coming from the fields the ore must be transferred twice and be moved one thousand miles As the lakes are closed by ice for three or four months, the companies must store up in summer sufficient ore to last through the winter Many of the plants and equipment are old and the plants are located in deep valleys beside the rivers without sufficient area for modern expansion and improvement (Fig. 282)

**The Lake Erie Region.** The Lake Erie region stretches from Buffalo to Toledo and Detroit and has many advantages for making iron and steel. From a map name the cities that are important in this region. Iron ore from lake freighters is dumped in huge yards near the door of the furnaces. Coal has to be brought from the northern Appalachian field, but the railways carry it cheaply in cars that otherwise might move back to lake ports empty. The Buffalo district has the advantage of hydroelectric power from Niagara Falls, which gives economical operation Limestone, quarried from nearby islands in the lake, or from the western shores of Lake Huron, moves cheaply to the furnaces. Along the lake are large areas of cheap, level land for the huge mills. Water is easily taken from the lake. Excellent labor is available in huge quantities. The plants have water and rail transportation competing with each other for the traffic, and have access to the sea via the St. Lawrence River and the New York Barge Canal. Finally, the plants find a huge market in the nearby cities and in the great manufacturing region of the continent, including the Canadian centers

**Chicago-Gary Region.** As in the Lake Erie region, the Chicago-Gary region draws by water its iron from northern ore fields and its limestone chiefly from the western shore of Lake Huron Lake freighters dump these materials at the door of the furnaces as cheaply as at those of the Lake Erie region Most of the coal comes from the northern Appalachian field by rail-lake and by all rail for five hundred miles, although some comes from the eastern interior field

This region has several advantages for manufacturing iron and steel. There is much cheap land near the shore of the lake for building the huge plants (p 335). There is an ample supply of industrial water and much high-class labor. But the great advantage of this region is found in its location in the western half of the manufacturing region of east central North America and in the greatest railway center of the world; most of the railway lines of the East, South, and West enter the region and they are connected by two belt lines The great plants make nearly all classes of iron and steel products Thousands of factories in the Middle West constitute a huge market for iron and steel in making automobiles, implements, industrial machines, furniture, Pullman and other cars, boilers, etc.

**The Middle Atlantic Region.** Most of the plants in this region are old and small compared to those in the other regions, but there are a few large modern plants in Pennsylvania and Maryland (Figs. 283 and 284). The furnaces of this region draw on the

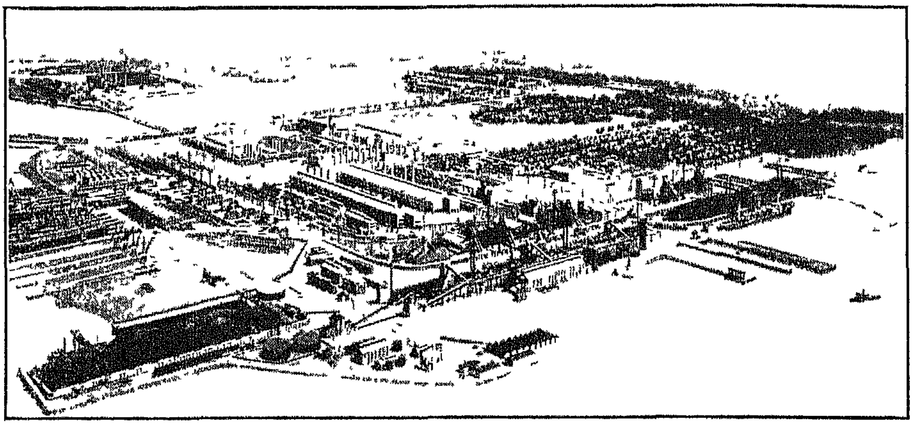



*Courtesy of Geographical Review, published by the American Geographical Society*

IRON AND STEEL DISTRICT, SPARROWS POINT, MARYLAND

FIG 283 The plants 1, Coke ovens 2, Blast furnaces 3, Electric power and blowing engines 4, Open-hearth steel departments. 5, Rail mill 6, Blooming mills 7, Plate mills 8, Skelp mill 9, Rod and wire mill. 10, Pipe mills 11, Tin plate mills 12, Sheet mills The scale of the map is approximately one inch to 3700 feet What advantages does the seaboard location give this great unit of the Bethlehem Steel Company?

northern ore fields, several small eastern fields, and foreign fields for iron ore. They also use much scrap iron. From what countries does this region import ore (p. 319)? The imported ores average 54 to 65 per cent iron and some of them have special qualities. Though coming a long distance, ocean transportation is cheap Limestone comes less than one hundred miles by rail from quarries in eastern Pennsylvania. High-grade coal and coke come from the northern Appalachian field, and much moves across Virginia and up Chesapeake Bay. The plants in eastern Pennsylvania take industrial water from rivers, but Sparrows Point, located on salt water, pumps it from deep wells The most densely settled area of the United States provides ample labor and a great market. The area from Portland to Richmond, reached by rail or water, comprises one of our great steel markets. structural steel in the great cities, huge factories, and on highways, steel for car, locomotive, and track equipment in the greatest railway net of the country; plate for shipbuilding, tin plate for canning, wire and cable for telephone, telegraph, and electric transmission, and a variety of iron and steel for electrical machinery, textile machinery, machine tools, etc. No other part of the country demands a greater variety of iron and steel prod-



*Courtesy of Bethlehem Steel Company*

SPARROWS POINT PLANT, BETHLEHEM STEEL COMPANY

FIG. 284. Compare with the map and pick out the various units of this great iron and steel plant

ucts in huge quantities, and a location on the seaboard favors exportation.

**Other Regions.** Outside the above regions are small scattered districts in Virginia, Tennessee, Colorado, and Utah which use local materials and supply a local market. The Ontario and Montreal districts use United States ores and coal and local scrap iron. The Cape Breton district has good coal and limestone and draws its ore from Newfoundland, but it is handicapped by being so far away from the great North American market and by the freezing of the St. Lawrence for nearly five months.

**The Position of the United States in the Iron and Steel Industry.** What per cent of the world output of the following does the United States produce: iron ore, pig iron, and steel (p. 323); coal and coke (p. 328); automobiles (p. 362); agricultural implements (p. 366)? Our preeminent position in the iron and steel industry results from (1) large resources of iron ore, coal, other minerals, forests, water power, and farming lands, (2) the development of iron and steel manufacture in several regions, (3) great railway mileage, (4) cheap lake and river transportation, (5) modern development of all lines of industry, (6) large population with a high buying power, (7) invigorating climate, (8) much capital, and (9) stable government.

## EXERCISES

1. (*a*) Illustrate by a diagram what takes place in a blast furnace. (*b*) Note the location of the blast furnaces of the United States (p. 319). What four regions have most of them? (*c*) What is the difference between the blast furnaces of Gary and those of Virginia?

2. Outline the conditions that favor the production and marketing of iron and steel in the Alabama region.

3. (*a*) Compared to the Alabama region, what handicaps does the leading iron and steel region of the country have? (*b*) What advantages?

4. Compare and contrast the Lake Erie and the Chicago-Gary regions.

5. Why do eastern Pennsylvania, New Jersey, and Maryland have a great iron and steel industry?

6 What handicaps do the Canadian districts have?

7 List the conditions that explain the United States' leadership in the iron and steel industry of the world. Summarize your comparison and contrasts of districts in table form

| *No Alabama* | *Pittsburgh* | *Lake Erie* | *Middle Atlantic Region* |
|---|---|---|---|
| Coal | | | |
| Iron Ore | | | |
| Limestone | | | |
| Water | | | |
| Land | | | |
| Transportation | | | |
| Market | | | |

## EXTRA LESSONS

Students living in one of the iron and steel areas may wish to make a more detailed study of their district Steel companies may willingly supply pamphlets and pictures Following are good references for certain areas

"Birmingham, Alabama" — A, IV (1928), 349–365, 45.

"Pittsburgh District" — A, IV (1928), 115–139, 1, pp 39–45, 12, pp 325–326; 7, I, pp 292–301.

"Mahoning Valley" — "The Iron and Steel Industry of Youngstown, Ohio," *Denison Univ. Bull., Jour of Sci Lab.*, Vol XXV (1930), 125–146, 47.

"Wheeling, West Virginia" — A, VIII (1932), 274–281

"Cleveland, Ohio" — "The Iron and Steel Industry of Cleveland, Ohio," *Denison Univ Bull, Jour of Sci Lab*, XXIV (1929), 81–95, 12, pp 326–327

"Buffalo" — "The Iron and Steel Industry of the Buffalo District," *Denison Univ Bull, Jour. of Sci. Lab*, Vol. XXIV (1929), 245–264

"The Chicago District" — 12, pp 327–328, *Univ of Ill Studies in Social Sciences*, Vol. XIII (1925), 38.

"Sparrows Point" — J, XXI (1931), 244–258.

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"The Essentials for an Iron and Steel Industry" — 7, I, Chapter XLI, 70, Chapter IX, first part; 86, Chapter VIII, 23, pp. 386 ff.; 20, II, Chapter XII

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"Iron and Steel Industry of the United States" — B, XXVIII (1929), 133–153; 95, Chapter XIII, 12, pp. 315–324.

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[1] Numbers and letters refer to Selected References on pages 420–424

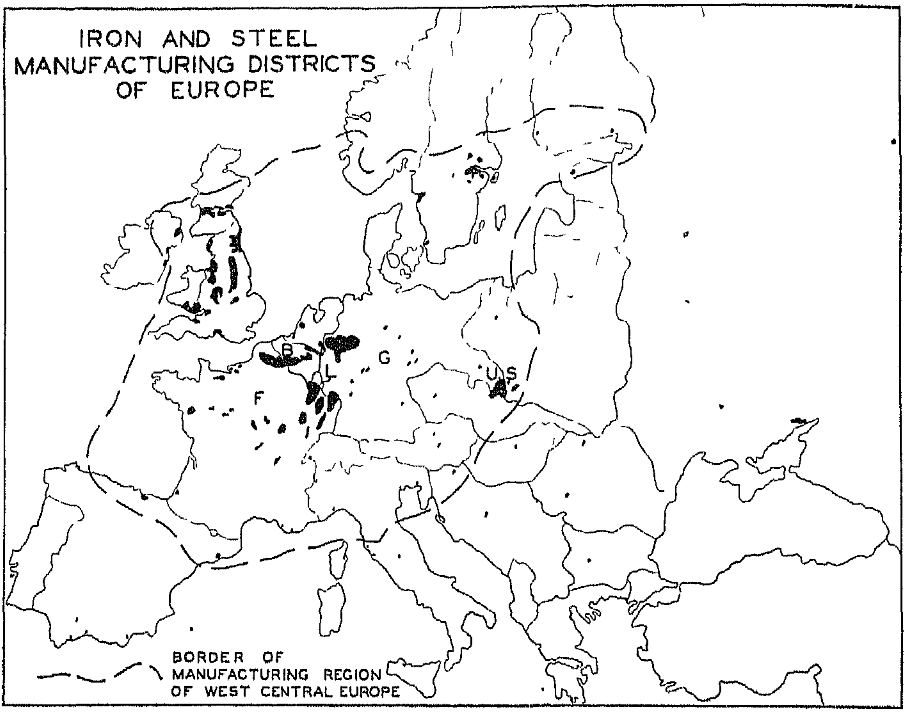



FIG 285 Nearly every country in Europe produces iron and steel, but two districts manufacture most of the Continent's pig iron and steel Compare the two regions with the iron ore fields and the movement of ore (page 321) and the coal regions (page 284) What countries are the great importers of iron ore?

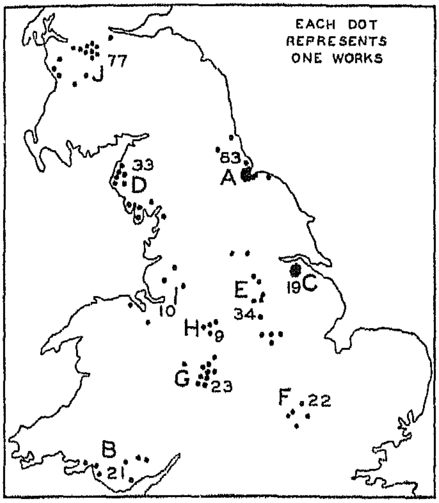
## § II — OTHER IRON AND STEEL REGIONS

East central North America and west central Europe produce nine-tenths of the world's pig iron and steel (p 323) A little is produced in Russia, India, China, Japan, and Australia

Many districts in Europe manufacture iron and steel, but two great regions produce most of them (Fig. 285). These are the districts of Great Britain and those in the great triangular area, embracing the Ruhr of Germany, and the eastern and northern districts of France, Belgium, and Luxembourg (p. 352) These two areas have advantages not possessed by any other large regions of Europe

**The Iron and Steel Districts of Great Britain.** The iron and steel districts of Great Britain fall into two groups. inland (Fig. 286, E, F, G, H, I, J) and coastal (A, B, C, D). Among the inland districts are some of the oldest iron manufacturing regions of the world. They had the advantages of an early start. They grew up in areas having local deposits of iron ore, abundant forests for fuel and charcoal for smelting, limestone for flux, and coal for coke. In places these minerals were taken from the same series of rocks near the surface. As early as 1730 one inland district was manufacturing coke for smelting iron.

In them were skilled laborers engaged in hand industries, and hundreds of machines were invented and applied for the use of water and steam power. Canals and railroads were built at an early date. As late as 1850 the inland districts mined three-fourths of the world's coal and made nearly all the pig iron and steel of Great Britain. They produced nearly 50 per cent of the world's pig iron and 70 per cent of the steel.




*After L. D. Stamp*

BRITISH SMELTING WORKS

FIG. 286. The figures represent the number of furnaces in a recent year. The districts: A, Northeast coast; B, South Wales; C, North Lincolnshire; D, Northwest coast; E, Yorkshire-Derby-Nottinghamshire; F, Leicester-Northants; G, South Staffordshire-Galop; H, North Staffordshire; I, Lancashire-North Wales; J, Scottish Lowlands. In general, the inland furnaces are old and small and have only a fraction of the capacity of a large modern furnace on the coast.

In the early days of the industry in the inland districts considerable specialization took place. Special qualities of iron ore, together with special skill of workers, made it possible to meet special demands. With the decline in the output of iron ore and in some places coal, districts have increased their specialization in small but valuable finished iron and steel products. Even though less than one hundred miles from the sea, the inland districts cannot profitably import huge quantities of iron ore on account of their old, small furnaces and antiquated equipment. Some of them can afford to import comparatively small amounts of high-grade ore and high-grade pig iron and steel for the manufacture of articles of high grade. They also use chromium, manganese, tungsten, nickel, and molybdenum for making special steels, but only in small quantities. Yorkshire and Lancashire manufacture most of the textile machinery. Other districts on the flanks of the Pennines and at the southern end of this range make forge and foundry products for the metallurgical and engineering industries — stoves, iron pipes for water mains, automobiles, cycles, locomotives, electrical supplies, agricultural implements, etc. Sheffield, located in district E, is known all over the world for its cutlery, high-speed tools, and stainless steel. Skilled labor, high-grade coal, water power, much pure water, millstone grit for grindstones, all favored this high specialization at Sheffield. This same specialization tends to hinder expansion into mass production of rough iron and steel products, which has developed in the coastal districts.

The coastal districts produce more than three-fifths of the total pig iron and raw crude steel of Great Britain. They have developed rapidly in recent years. In addition to the chief districts, a portion of the industry of the

Scottish lowlands is also a coastal district.

The northeast coast is the leading district, now producing more than one-fourth of the pig iron and steel of Great Britain. In general, the advantages for manufacturing iron and steel in this district illustrate those possessed by all the coastal districts. The advantages of this district include an abundant supply of 30 per cent iron ore in the Cleveland hills within twenty miles of the great furnaces and steel plants at the mouth of the River Tees, large supplies of high-grade coking coal in the Northumberland-Durham field only twenty-five miles away and accessible by railways and coastal water transportation, abundant limestone for flux in Durham nearby, location on the improved Tees estuary affording access to large ocean vessels, the ease with which the foreign ores carrying from 50 to 60 per cent iron for mixing with the low-grade ore may be unloaded on the wharves at the furnaces, low freight rates on the imported ores because of an abundance of outgoing heavy freight especially steel products and coal, coastwise shipping providing a cheap movement of steel to other coastal manufacturing centers, a large skilled labor supply, excellent railway connections with all parts of Great Britain, abundant space for this type of industry; and the development along modern lines, including close cooperation in the industry from the coal mines to blast furnaces, finishing mills, and the marketing of the products. Companies have been formed to bring under the control of one organization all phases of the industry. Located on the sea this district can market its products readily in all parts of the world while it has easy access to all the districts of Great Britain.

The northeast district manufactures a variety of products: steel sheets, plates, shipbuilding materials, structural steel of all kinds, steel rails, railroad equipment, and tubes. This district has the leading shipbuilding industry of Great Britain, with more than forty companies engaged in shipbuilding and distributing vessels to all parts of the world. Ranking with this district in shipbuilding is the Clyde Valley in Scotland. Here within twenty miles below Glasgow more than thirty firms build a great variety of ships, large passenger liners being a specialty. These two areas and the northwest coast build nearly nine-tenths of the ships of Great Britain.

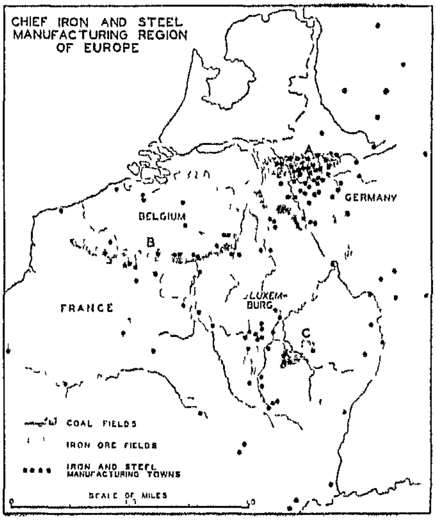
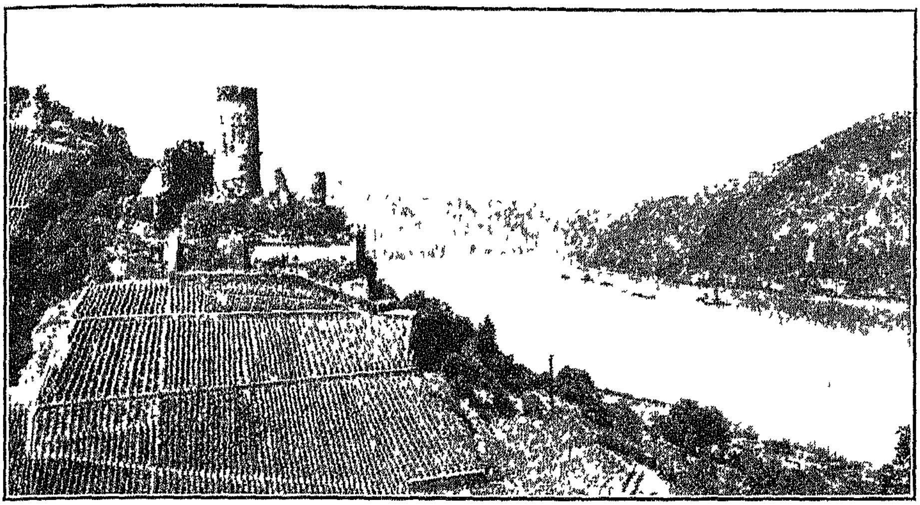



FIG. 287. The three principal districts of this region are the Ruhr, central Belgium and northern France, and northeastern France (Lorraine and Alsace) and Luxemburg. Note the relation of coal, iron ore fields, and the iron and steel manufacturing towns.

In contrast to these districts, South Wales specializes in the manufacture



Courtesy of German Tourist Information Office

TWO FLEETS OF BARGES ON THE RHINE

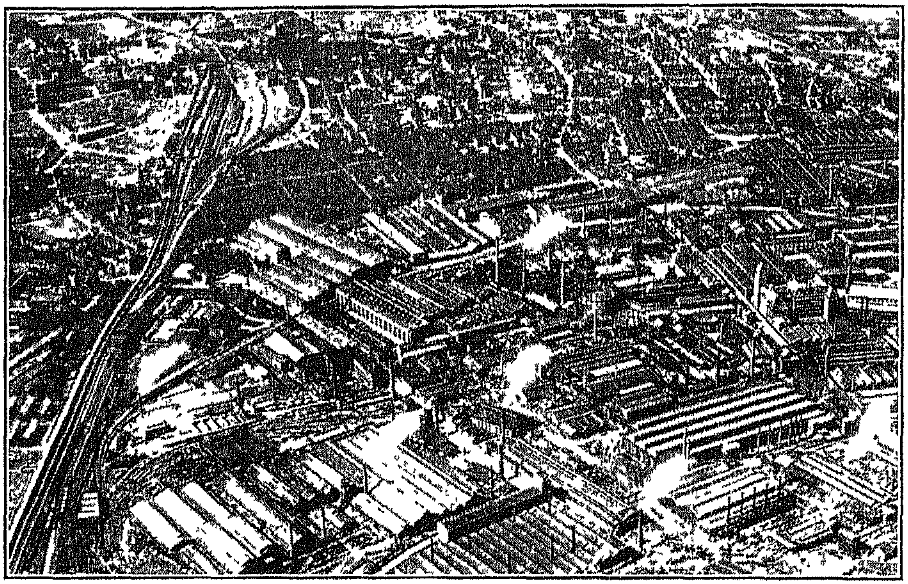
FIG. 288 The steel region of the lower Rhine is a network of canals, rivers, and railways that aid manufacturing of all kinds

of tin plate and tin products Nearly all the steel mills of the district are connected in one way or another with the tin plate mills. It is the leading tin plate manufacturing region of the world

In addition to the points mentioned above, Great Britain's position as an iron and steel manufacturer has been helped by its great development of other industries, dense population, large amounts of capital, and trade connections with all parts of the world To continue its iron and steel manufacturing, it must import huge quantities of raw materials and foodstuffs and sell wares in widely scattered markets

**Europe's Chief Iron and Steel Region.** The great triangular area, comprising the Ruhr of Germany, two districts of northern France, Belgium, and Luxembourg, is the leading iron and steel region of Europe (Fig. 287). The graph (p 323) shows the relative importance of these countries in the world's pig iron and steel production The blast furnaces, steel mills, and related plants cluster closely in three portions of the region, the steel plants in this region produce most of the output of these countries Though shared by four countries, this region is one economic unit Its great development has taken place during the past half century after the invention of the basic open-hearth process to use the Lorraine ore containing phosphorus The region has many advantages for the manufacture of iron and steel.

The Lorraine field is the second greatest iron mining district of the world What conditions favor iron mining here (p. 322)? It lies in one of the districts and within one hundred fifty miles of the Ruhr and one hundred miles of the Belgian-northern France district. What countries use enormous quantities of Lorraine ore (p. 321)? What other countries send this region much high-



Courtesy of German Tourist Information Office

FIG 289 AERIAL VIEW OF PART OF THE KRUPP STEEL WORKS, ESSEN, GERMANY

grade iron ore, carrying from 50 to 65 per cent iron? Which districts depend largely upon imported ore? Much of these ores is self-fluxing and limestone to flux is mined also near the blast furnaces.

Each district is in or within a great coal field which mines high-grade coal and makes most of the coke of continental Europe (p. 328) What conditions favor coal production in the Ruhr (p. 329)? The furnaces near the sea secure coal and coke cheaply from Great Britain.

Transportation facilities are especially favorable (Fig. 288). Competing canal, river, and rail lines connect the ore, coal, and steel districts and tie them to the nearby Atlantic ports through which come ore, coal, and foodstuffs and out of which are shipped numerous manufactured products. No region has a better net of transportation facilities. Much use is made of the cheap barge transportation for raw materials and fabricated wares.

The region is the heart of the manufacturing belt of Europe (Fig. 289). Its dense population provides a great market for all kinds of iron and steel products. Its thousands of manufacturing plants turn these into numerous finished wares and make use of many by-products of a great coke and steel manufacturing area. Also the focus of continental land routes on this region facilitates the distribution of products to many sections of inland Europe. Its location near and its connections with the sea open the world markets to its factories. In addition the huge corporations have employed the most modern methods of mining, making coke, smelting iron, and converting it into high-grade steel with many alloys. They have also given every attention to marketing the finished articles. At times the steel companies have formed huge com-

bines or syndicates in order to eliminate uneconomic competition and to allocate markets.

**Other European Regions.** Most of the countries of Europe produce iron and steel goods, but in small amounts

Before the World War the Upper Silesia district was a significant part of Germany's iron and steel industry (p 350) The boundary lines made at the end of the war cut through the

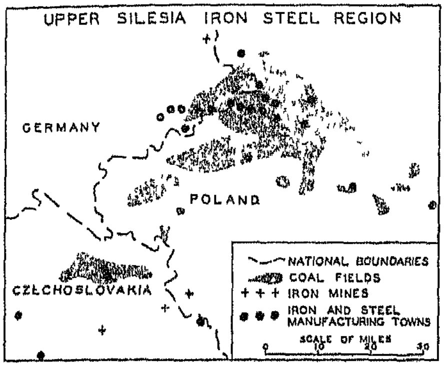



FIG. 290 Note how the national boundaries cut across the iron and steel region

district, even cutting in half mines and steel plants belonging to one company. In only four coal mines is mining continued by agreement under the boundary line. Many workers living in one country have to cross a boundary line and pass inspection daily to go to their work. The district is in Germany, Poland, and Czechoslovakia (Fig. 290). In comparison to the Ruhr the district is of little consequence but it has the chief metallurgical industries of Poland and Czechoslovakia. The district has used up most of its iron ore so that it imports from several regions (p. 321). It has many coal mines, but the coal is not so good as that in the Ruhr or Saar. It has good transportation, but it is greatly handicapped by being crossed by international boundaries and by trade restrictions

Russia has several iron and steel districts: (1) Krivoi Rog in the Ukraine with good ore and only one hundred eighty miles from good coking coal in the Donets Basin, (2) near the southern end of the Ural Mountains, and (3) at Moscow The Russian industry may expand greatly

Central Sweden makes only a small amount of iron and steel, but these are of very high grade Sweden has much iron ore Having little coal, most of the iron ore is refined with charcoal and the use of water power. The well-regulated forests provide ample charcoal and Sweden has much water power. Charcoal and electric steel give Swedish metal products a world-wide reputation Much Swedish steel goes to Sheffield for high-grade cutlery.

Italy has several small districts based on local coal and iron ore from the island of Elba and ore imports from many countries Northern Spain manufactures some iron from its great ore deposits by using coal brought cheaply in the ships from western Europe that come to get iron ore.

**Regions in Asia and Australia.** Outside of North America and Europe all other districts produce less than 10 per cent of the iron and steel of the world. Japan, India, and China make most of the iron and steel of Asia Japan has little iron ore but good coal, though mined with difficulty, and it also has control of many Chinese coal and iron mines. Nearly three-fifths of the Japanese output comes from the southern island, Kyushu, which has coal and lies near

foreign ore Japan has plants in Manchuria and Chosen Most of China's output comes from Hankow on the Yangtze Kiang India's production is nearly all in a district west of Calcutta that has both coal and iron and good transportation Both China and India have large resources of coal and iron The districts in Asia are handicapped by poor transportation facilities, lack of capital, lack of mechanical skill, the low buying power of the millions of poor farmers and the fact that the manufacturing industries of these regions are chiefly of the household or community type

Australia has the chief iron and steel industry of the Southern Hemisphere It has the chief coal resources of the Southern Hemisphere and ample supplies of iron ore and limestone Its industry is in the southeastern part of the continent near Sydney, where coal, iron, and limestone are close together and near the sea This region has good transportation facilities, an energetic population, and a rapidly growing market.

## EXERCISES

1 (*a*) What percentage of the world's iron and steel is produced by east central North America and west central Europe? (*b*) What two types of districts does Great Britain have?

2 (*a*) What conditions favored the early development of the inland districts? (*b*) What types of products do they make today? (*c*) Explain why Sheffield is world famous for its cutlery, high-speed tools, and stainless steels (*d*) Outline the conditions that favor the northeast district of Great Britain (*e*) Why have the coastal districts developed a different type of industry from the inland districts?

3 (*a*) Outline the advantages for iron and steel manufacture of Europe's chief region (*b*) Answer the questions in the text on this region

4. What handicaps has the Upper Silesia district?

5 Why is the small output of central Sweden so significant?

6 (*a*) List the conditions that retard a great expansion in iron and steel manufacturing in southeastern Asia. (*b*) Why does Australia have the chief iron and steel manufacturing region of the Southern Hemisphere? (*c*) What continents manufacture very little iron and steel?

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"The Chief Steel Region of Europe" — 12, pp 526–531, 72, pp 18–29, 99, No. 703, pp 16 ff, 31 ff, B, XXVII (1928), 252–256, C, XLI (1922), 553–564
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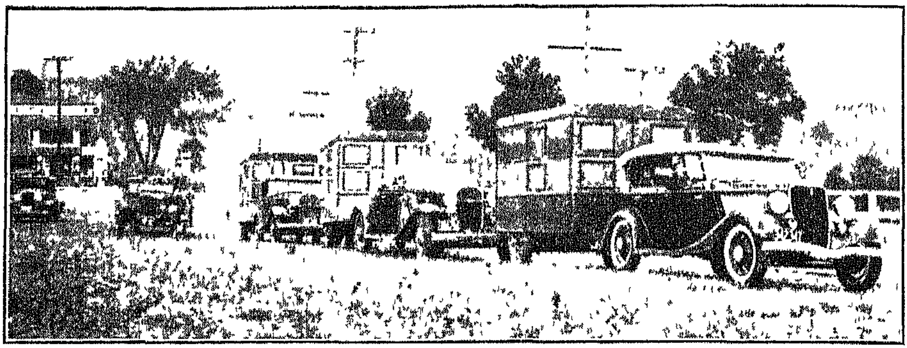
[2] Numbers and letters refer to Selected References on pages 420–424



MODERN AUTOMOBILE TRANSPORTATION

FIG 291 The split-coach trailers pulled by small cars represent a recent development in cheap, convenient transportation for field parties This is part of the Clark University School of Geography equipment for field work each fall.

CHAPTER XXXIV

# THE AUTOMOBILE, IMPLEMENT, AND MACHINERY INDUSTRIES

Among our manufacturing industries the automobile, implement, and machinery industries hold special interest. They have caused great changes in transportation and agriculture the world over. They show the influences of geographic conditions and are important industries for us and ones in which the United States has a leading position (Fig. 291).

## § 1 — THE AUTOMOBILE INDUSTRY

**Importance of the Industry in the United States.** In 1929 when every type of industry was expanding, the automobile industry, in value of manufactured product, took first place in American industry This youngest of all great industries, scarcely more than thirty years old, had become greater than such industrial giants as meat packing, steel works and rolling mills, and foundry and machine shop products. In 1932 the value of our automobile exports was fourth in rank. The automobile industry means life to many others which furnish the material for it. It absorbs 85 per cent of the gasoline and 81 per cent of the rubber used in the country (Fig. 292). It furnishes a market for more than half of the plate glass, malleable iron, lubricating oils, and upholstery leather. It purchases over one-fourth of the lead, nickel, and mohair used in the country, as well as a tremendous quantity of more than seventy-five other commodities. The industry employs directly or indirectly one-tenth of all the workers of the country and likewise furnishes through gas tax, registration fees, and

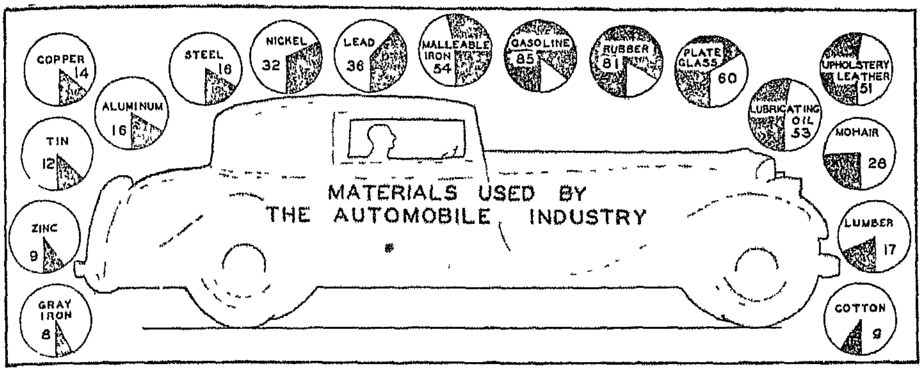



FIG 292 The automobile industry in the United States uses the percentage indicated of our total production of the articles in the circles

personal property taxes, one-tenth of the taxes of all forms of government in the United States

**Historical Development of the Automobile Industry.** The first motor car was developed in France in 1891. The industry, however, in a couple of years had begun in the United States, where it found a fertile field and began its meteoric rise to rank as a leading industry in this country

The first automobiles could hardly be looked on as something entirely new for the vehicle was merely a carriage with a one-cylinder gasoline engine placed in it and connected in such a manner as to make it go. In those days, however, these machines were marveled at. People who had seen one would gather in groups to discuss it and horses and cattle in pastures would flee with heads and tails high from the road fences as one of the new inventions came sputtering and rattling down the bumpy or dusty road. From this simple beginning the industry gradually developed until by 1900 four thousand automobiles were produced in the United States. Then the great development began and by 1910 the annual production had risen to nearly two hundred thousand. By 1929 it had reached five and one-half million Not only did great changes take place in the number of cars manufactured, but the change in quality was likewise marvelous From a makeshift buggy with a one-cylinder gasoline engine to the beautifully built, powerful cars of today is such a great change that one can hardly help smiling when looking at the old horseless carriage. From cars that could scarcely travel ten miles an hour on level roads, that required a mechanic to keep them running, that were so uncomfortably built that a twenty-mile journey was a great task, to the present automobile which glides along quietly at sixty miles an hour, runs up or down hill equally well, has luxurious upholstery and even radio music, is indeed an achievement worthy of high praise. And with these improvements the price of the automobile changed materially. In 1900 a two-cylinder touring car sold for $1200 whereas an eight-cylinder touring car of the same make today sells for about half that amount.

**Localization of the Industry in the Middle West.** Nearly half of the automobile factory workers of the United States are found in Michigan. The

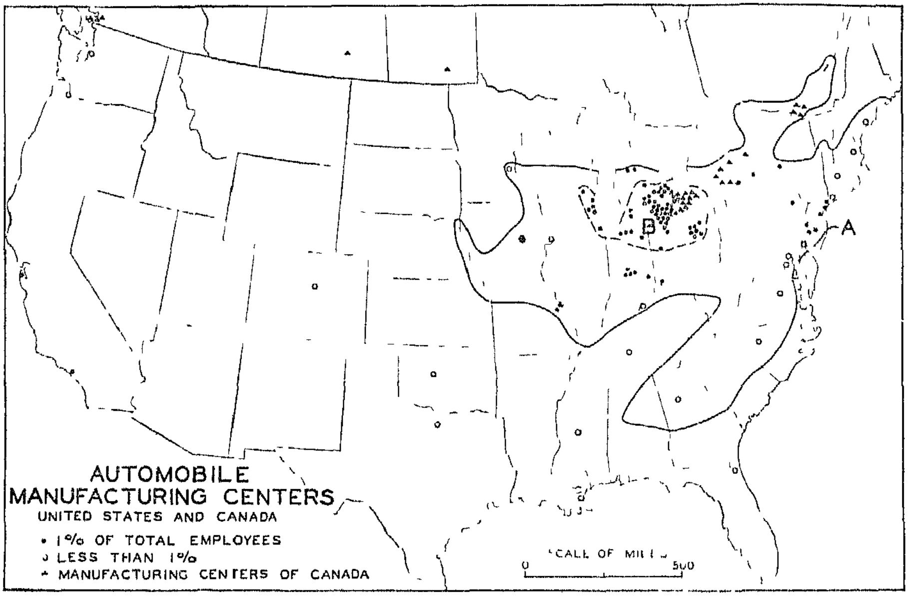



FIG 293 In a recent year the total number of employees in automobile factories in the United States was 225 000, in Canada 14,000 A, the manufacturing region of east central North America, B, the automobile manufacturing belt What percentage of the employees does this belt have? Explain the distribution of automobile factories in Canada

three leading states, Michigan, Ohio, and Indiana employ over two-thirds of the total United States automobile factory workers With the rapid growth of the industry, mass production methods led to a greater and greater concentration in large factories The factories, however, a few years ago reached a point where they were getting too large Besides that foreign import taxes were becoming so heavy that the plants began building branch assembling plants. The advantage of cheaper land and labor as well as the greater ease of shipping parts rather than built machines led to the establishing of such assembling plants in various places in the United States.

The question arises as to the reason for the development of the industry in the agricultural Middle West rather than in the highly industrialized East (Fig 293) The explanation has both a geographical and an economic basis. Because of the importance of motor boats on the lakes of this region, especially Lake Erie, there had grown up an important marine engine industry and because of the supply of wood and location of the principal market 60 per cent of the carriages produced in the United States were made here Now the early "horseless carriage" was nothing more than a combination of a buggy and a marine engine, so it is logical that the development of the automobile industry should begin where these were produced. Besides that, Detroit and nearby cities were already making malleable iron, pressed steel, springs, brass parts, and paints and varnishes — all necessary to the automobile industry. The lo-

calization of the bicycle and buggy the industry was also an advantage Though this region had an advantage in this respect, buggies and marine engines were also common in New England, but geographical conditions were not so favorable to the use of a crude horseless carriage and distances were not so great In the Middle West were large areas of flat land which favored experimentation with the early automobile, which had so little power that it could not be operated in hilly regions Besides that, in this section where glacial gravels were plentiful and where road building was easy, the best roads of the United States were found The roads dried quickly after rains and were seldom blocked because of heavy snows in winter The reverse of these conditions made it impossible for the east to get through the experimental stage so easily Many eastern factories started but could not keep going because conditions were so unfavorable Of considerable importance, also, was the more daring and reckless spirit of pioneer people in the west. They had become accustomed to continuous changes and welcomed with open arms any innovation The conservative easterners also saw greater disadvantage in driving the new contraption in a hilly country. Located not far from the great iron and steel mills and glass factories of Pittsburgh, near a plentiful supply of hard wood, near coal having especially favorable freight rates, having access to excellent lake and railroad transportation as well as being near the early Lima, Ohio, and eastern interior oil fields, were advantages that accentuated the other favorable conditions of the Middle West.

Men interested and experienced in making marine engines and carriages fitted well into the scheme of the horseless carriage which was merely a combination of the two at the outset They were pioneers in the art of transportation and developed into valuable workers Not only was the supply excellent, but it was plentiful The bicycle industry, and lumbering and agriculture in northern Michigan had been declining, so a surplus of men was available for the new industry By the time this surplus was absorbed immigrants filled the necessary places

Profits made from other industries of the Middle West were seeking places of investment and readily backed up the infant automobile industry In the East the more conservative capitalists found plenty of other more stable industries in which to invest their money

The industry has continued to be concentrated in this region The early start and rapid growth made the industry so gigantic in the Middle West and of such importance that new enterprises in order to find trained men for companies making standard parts had to locate here Also, in Michigan, Ohio, and Indiana the automobile business permeated the very life of the people, they lived where the industry had become a part of their lives, hence new enterprises associated with the growing automobile industry found it much easier to develop The excellent position that formerly prevailed for assembling still prevails The center of population of the United States has continually shifted westward. It reached eastern Indiana in 1890 and was in western Indiana in 1930. This means that the auto industry is in the center of the potential

market for automobiles for both private and commercial use

**Dominant World Position of the United States Automobile Industry.** With all the automobiles in the United States filled with five passengers or less it would be possible for every man, woman, and child in the United States to be in an automobile at the same time. If the same thing were planned in China there would be ten thousand people in every automobile, in Germany one hundred, in England twenty-eight, in France twenty-four. Why does the United States produce approximately 85 per cent of all the automobiles of the world? Why does it use 75 per cent of the automobiles when it has less than 7 per cent of the people? The explanation lies in the vast wealth of a nation that grew so rapidly and became so rich that no country in the world can even compare with it It spends millions of dollars, and thousands of workers spend their lives, in making and improving the American automobile Motor cars have been standardized and reduced in price so that most people can own one. Also this country has an advantage in the low price of gasoline

America is the great market for automobiles but the gap between the use of automobiles here and in the rest of the world will lessen. Of course, with the great distances to travel in this country the need for automobiles will continue to be greater than in such places as Germany or England However, the Union of South Africa, Argentina, Brazil, Australia, and other large countries will more and more demand this means of rapid transportation.

The reason that the United States exports several times as many automobiles as all other countries combined is due to our high-quality, low-priced cars that are built to stand poor, rough, mountainous roads as well as excellent paved roads They are built for power, rough use, and speed. In such countries as Germany, France, and England the need for these qualities is much minimized. When such frontier countries as the Union of South Africa, Australia, Argentina, and Brazil buy automobiles they must have in them the same qualities as those found in the American automobile, for those countries are rugged, have poor roads, and cover large areas Because of America's immense home market and mass production, it can make automobiles at a low enough cost to compete with other nations whose labor cost is much less.

## EXERCISES

1 Give facts from the text and pictures to show the importance of the automobile manufacturing industry to the United States.

2. (*a*) List six or more factors to explain why most of our automobiles are made in the Middle West. (*b*) Why does the United States manufacture 85 per cent of the world's automobiles? (*c*) Why are our cars so important in export trade?

3. Obtain materials from a large automobile concern and prepare an exhibit that will illustrate the evolution of the automobile from the beginning to the present; 69, Chapter II.

4 From reference number 34 in the list of Selected References make a percentage *pi* chart of the "World Production of Motor Vehicles" by countries.

## AN EXTRA LESSON

"The Rubber Manufacturing Industry of the United States" — Bring out the importance of the industry, the distribution of manufacturing in the United States, the reasons for the distribution, and the relation of rubber to other industries References Recent Biennial Census of Manufacturing, United States Department of Commerce — Rubber, **D**, CXVI (November, 1924), 259–261, **7**, I, Chapter XLII, **20**, II, Chapter IX, **42**; **32**.

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## § II — AGRICULTURAL MACHINERY

**Dominance of Hand Methods of Farming until 1800.** One of the striking differences between man and animal is the ability of man to use implements to aid him in his struggle for existence. Primitive man was able to survive in the period during which he procured all his food by hunting and fishing, because he was able to use implements for weapons. Later he tamed wild animals, kept them in herds, helped them to find food, and protected them from other animals. As long as he could find feed for his animals he assured himself of food. Nomadism changed gradually as man learned to plant food crops. At first he settled in one place only long enough to raise a crop, then wandered from place to place with his herd. Later he found more favorable regions for planting crops and settled down more or less permanently. When man first planted seeds, he probably used his hand to dig the holes If he planted many seeds, it was difficult to dig all the holes with his hand, so he used a stick or stone From this crude beginning primitive man gradually learned to shape his stick in such a way as to make it easier to work with. Maybe he accidentally used a stick somewhat the shape of a hoe and was so well pleased that, when it broke, he fashioned another similar in shape.

From the hoe to the crooked-stick

[1] Numbers and letters refer to Selected References on pages 420–424.

plow was not a great change Undoubtedly the first plow was pulled by man but after many centuries he hitched animals to the plow[2] For hundreds of years few improvements were made. Plowing was done with a crooked-stick "Egyptian plow," drawn by oxen, or if the farm were small enough all the work was done with a hoe A wooden harrow and a spade supplemented these Corn was planted by placing each kernel by hand in the hole dug with the hoe or plow Other grains were scattered by hand "broadcast," then the land was harrowed to cover the seed Harvesting was done with a scythe, later a cradle Grain was tied in bundles by hand using straw instead of twine The grain was then trampled by animals or pounded out by hand with a flail These methods or cruder ones prevailed in all parts of the world until approximately 1800 With the coming of the age of iron and steel the field of improvements was almost unlimited Changes took place in the next hundred years that were many times greater than all the improvements of the previous thousands of years.

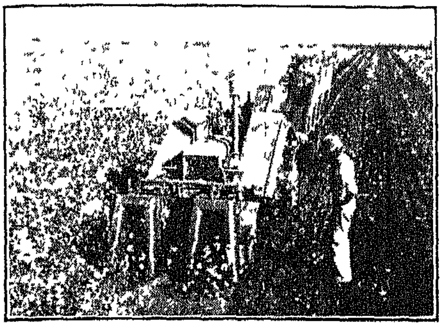
**Introduction of Machinery Revolutionized Farm Methods after 1800.** The use of iron and coal in the production of steel lies as the very foundation of the great era of agricultural machinery development Without these basic minerals it would be impossible to make such implements as the tractor, binder, or drill. Today no country that does not mine iron and coal, or import them, has made progress in the production of agricultural implements

Although many of the first agricultural machines had their beginning in Europe, their major development was in the United States It was in this country that the early ideas were developed While great improvements were made in Europe they did not keep pace with those in this country As a result, today the United States leads the world in quality and quantity of machinery produced

The first iron plow was made in 1797 but it was not until 1819 that the first cast-iron plow of several pieces was available Steel disks and harrows were later added to the machinery for preparing the ground Before 1740 Tull of England first attempted seeding with a drill However it was many years later before the drills and other planters became commonly available At the same time that Tull was trying out his drill he was also trying to use a horse-hoe or crude cultivator. It was almost a hundred years later that cultivators really began to be used as farm implements Spraying machines for use in destroying pests is a more recent innovation (p 190) Among the harvesting machines, the mower, rake, loader, and stacker help to lighten the work of haying The invention of the reaper in Europe in 1826 and the practical improvements made by the American, McCormick, a few years later, led to great saving in labor in the vast grain fields of the United States and Canada The threshing machine and, much later, the combine completed the necessary implements for harvesting rapidly and efficiently large amounts of grain Corn binders, corn huskers, and potato diggers also found a place among harvesting implements (pp 101 and 210). Though not completely success-

[2] In many parts of the world farming is still primarily a hoe agriculture

ful, a cotton picker has been developed (Fig 294) Among man's important crops only tobacco and the fruits have defied his genius for developing harvesting machinery



*Courtesy of Agricultural Experiment Station, College Station, Texas*

TWO-ROW TRACTOR-MOUNTED COMBINED HARVESTER AND BURR EXTRACTOR

FIG 294 The cotton picker is one of the latest developments in agricultural machinery This picker is mounted on a tractor, it picks two rows at a time and dumps the cotton into a wagon pulled by the tractor Notice the huge pile of cotton at the end of the field Harvesting cotton in this manner is possible only where the autumn decrease in rainfall causes most of the bolls to open and ripen at the same time and where very little or no rain falls during the harvesting period What would happen to the white pile of cotton if heavy rains fell on it?

The change from the crude implements to modern machines brought a need for a change in the type of power The new machines required greater power and speed, hence oxen gave way to horses and later many horses gave way to tractors. It is not likely that tractors will ever entirely supplant horses, for they play a definite part in farm economy from the point of view of crop rotation and fertilization Horse feed necessitates the production of grasses used in crop rotation and the manure available helps to keep the land fertile.

The savings effected by the use of machinery are enormous A combine run by two men can do the work formerly done by fifty-five cradlers and binders, one hundred flailers and sackers, and twenty handlers and stackers, or a total of one hundred and seventy-five men Where power is utilized extensively, the production per man is enormously increased In Italy with five workers to each horse the average production per man is only $45 In the United States with two horses to each man the production rises to almost $300 per man and in Nebraska with five horses per man the production reaches over $900 or twenty times as much per man as in Italy.

If man can produce a greater quantity more easily by using machinery and power, why do people like the Chinese continue to work in the same old way as they have for four thousand years? The food, clothing, and shelter demanded by each Chinese is small in contrast to that of the American In China three times as many people as in the United States live on much less land Whereas in our country we needed more laborers, in China there are millions who find nothing else to do except till the soil. In the United States the machinery is used on large farms, often hundreds of acres in extent, in China the farms comprise only a few acres. On a farm of this size the family can easily do all the work by hand. Most of the Chinese people have never heard of farm machinery and, if they have, they do not know what it is like. Even if they did want the machinery they could not buy it, for if a Chinese peasant saved all his life he wouldn't have enough to buy even one expensive piece of machinery.

**Influence of Geographic Conditions on the Use of Farm Machinery.** Relief, soil, and climate are vital factors both limiting the possibility of machine use and making its use necessary. Contrast the methods of planting corn in the gently rolling prairie by means of a corn planter with planting on a steep mountain slope where all the work must be done by hoe and hand In many places with rich but very rocky soils the modern gang plow cannot work successfully, whereas the old "Egyptian plow" made of a crooked stick with a steel point can run along and scratch the surface enough to loosen the soil. On the other hand it was not until the introduction of the much easier-pulling steel plow that the prairies of North America could be broken with any degree of success Climate perhaps more than any other factor is influential in limiting the types of machines or causing new types to be developed In moist regions where autumn rains come often and sometimes are accompanied by high winds, the binder may be used successfully, but the combine is eliminated (p 177). This is due to the necessity for the grain to be completely ripe before a combine can cut and thresh it, whereas a binder can cut the grain and it can be left for a while in the shock to get in a condition suitable for threshing The difficulty of waiting for the grain to completely ripen and dry out is that in the meantime a rain accompanied by a heavy wind might break down the grain, in which event much grain would be lost Great difficulty is experienced in humid tropical lands because of the rapid destruction of iron implements through rusting

**Why the United States Leads the World in the Production of Agricultural Machinery.** "Necessity is the mother of invention." In the United States, where labor was scarce and a demand for our food products great, we had to figure out some way to produce more food without the use of more men. The way we solved the problem was by inventing and perfecting agricultural machinery and using horse and tractor power (p. 201).

That was reason enough for a start, but many other conditions make the United States lead the world in both quantity and quality of product Here in America thousands of square miles of level land excellently suited to the use of machinery furnished a great laboratory for experimentation and at the same time made possible the financing of the great manufacturing enterprises. Nowhere in the world could the simple machines of early days be used more successfully than here on our level, almost stoneless, prairies. Nowhere else was soil so excellent and profits so high. The demand for our grain and the resulting great profits for the farmers supplied the money for the great quantities of machinery constantly being improved Nowhere in the world are there such quantities of iron and coal as in America and these minerals are the very life of the machinery industry (p. 319).

In contrast with the great success of the United States why did Great Britain fail to become a leader in the agricultural machinery field? It had the advantage of an earlier start than the United States, it had great quantities of iron and coal, and it had excellently trained factory workers. However, it lacked both the great home demand and the great labora-

tory for experimentation. In England fields and farms were small, labor was plentiful, and the demand for implements was so small that the great cost of production and experimentation could not be carried on.

**Geographic and Economic Bases for the Localization of the Industry in the Middle West.** The agricultural implement industry had its beginning in New York State, but the center of importance soon shifted to the Middle

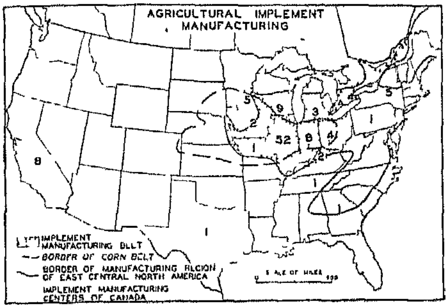
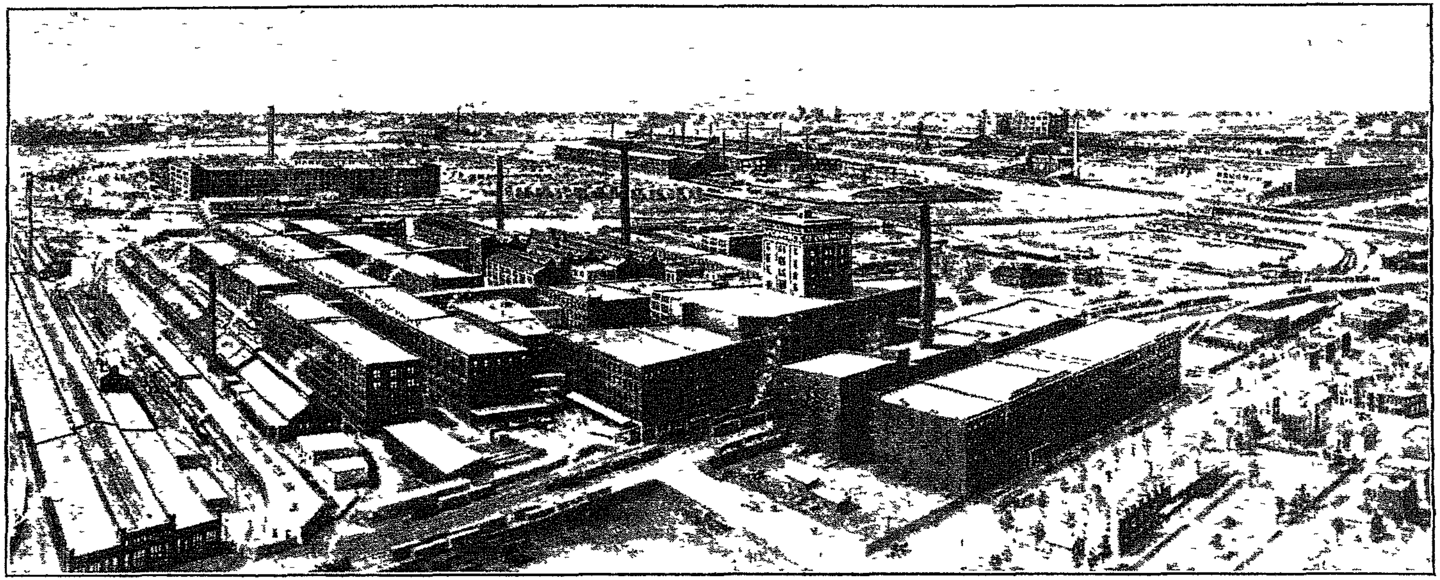



FIG 295 The figures in the states represent the percentage of our total production of agricultural implements (the figure in California should be 3 instead of 8) The states with numbers make 98 per cent of our total Why do California and New York make so many implements? Explain why the Ontario peninsula and the St Lawrence lowlands have most of Canada's implement-manufacturing centers.

West. Today Illinois produces over half of the total agricultural machinery manufactured in the United States. The agricultural implements belt (Fig. 295), comprising all or parts of Illinois, Wisconsin, Indiana, Minnesota, Ohio, Michigan, Iowa, Kentucky, and Missouri, produces 86 per cent of all farm machinery manufactured in the United States. California is an important producer because it is the center for the west coast region so far removed from the central region as to make freight rates on the bulky product almost prohibitive. New York is also important largely because of the advantage of an early start in the industry.

But the reasons for the great success of the Middle West as a producer of agricultural machinery are almost synonymous with the reasons for the success of the United States as the world's greatest producer (Fig 296). This was the region where vast area, fertile level land, and paucity of labor cried out for help to do the work of the farmer. This was America's great laboratory where nature beckoned and made conditions so favorable that early inventors were not discouraged. This was the place where all people were interested in machinery to such an extent that they were willing to spend millions of dollars for it. Conditions for manufacturing were excellent because iron, coal, and lumber were near at hand and freight rates on them were favorable Bulky products such as these are most economically produced and marketed near the consuming region. With factories in the consuming area, if a part of a machine broke or wore out, an interchangeable part could be obtained quickly and cheaply.

**International Trade in Agricultural Machinery.** The United States exports more agricultural machinery than all other countries of the world combined. A government official summed up the situation well when he said, "In popularity, American implements excel all others in nearly every country of the world, and where European-made implements are sold in preference to the American, it is generally on a price rather than a quality basis. The high esteem in which American implements are held is indicated by the fact that nearly one-third (over 40 per cent in



*Courtesy of International Harvester Company*

McCormick Works, International Harvester Company Chicago

Fig 296 This great plant is the world's largest farm machine factory By the huge buildings beyond the river notice the large piles of coal pig iron, and lumber Located on Lake Michigan, at the greatest railway center of the world, near coal iron and lumber and in the heart of a great farming country accounts in part, for Chicago's rank as the leading center of agricultural machinery manufacturing The International Harvester Company has trade connections to all parts of the world The scientific development of agricultural implements has given the farmers of this country and of foreign countries machines that perform efficiently and economically the tasks of plowing planting, cultivating, spraying, and harvesting our great crops like corn wheat cotton, potatoes and others Make a list of the crops still produced chiefly by hand methods in the tropics and in monsoon lands

1930) of the total exports are shipped to Europe, the most competitive of our foreign markets and the one where American implements encounter greatest rivalry from the products of European manufacture" Mass production for our great home market combined with efficient methods and the great decrease in number of types of machines makes the cost of each machine relatively low The decrease in number of types of machines from over 2100 in 1914 to 255 in 1926 also makes possible the use of standard interchangeable parts This is an important item, for broken parts can now be replaced quickly at a cost much lower than would otherwise have been the case

Ten countries of the world, headed by Russia, Canada, and Argentina, take 87 per cent of our total exports.

## EXERCISES

1 (*a*) Explain how man first began to use implements (*b*) What implements were used before 1800 to plant and harvest crops?

2 (*a*) Outline the development of the agricultural implements used in planting and harvesting wheat and corn (*b*) How did the change in machines cause a change in the type of power? (*c*) What are the chief values in the use of agricultural machinery?

3 Why do the Chinese use little farm machinery (p 141)?

4 (*a*) How is the use of farm machinery related to geographic conditions? (*b*) Make a list of the implements the corn-belt farmer of Illinois uses in raising his corn crop and harvesting it, (*c*) his hay crop (*d*) Do the same for the wheat farmer of Kansas, (*e*) the cotton farmer of western Texas

5 List the conditions that explain our leadership in the production of agricultural implements

6 Explain fully why 86 per cent of the agricultural implements are made in the Middle West.

7 (*a*) Why does the United States export more agricultural implements than all other countries combined? (*b*) Why does western Europe take so many implements? (*c*) What other countries are important buyers?

## READINGS [8]

"Statistics" — Biennial Census of Manufacturing — Manufacture and Sale of Farm Equipment — United States Department of Commerce

"The McCormick Works" — **50.**

"Effects of Machinery on Wheat Production" — **24,** pp 30-34, **106** (1927), pp 692-697

## TOPICS FOR INVESTIGATION AND REPORT

"Factors in Location of Agricultural Implement Plants" — Text, **23,** pp. 587-593

## § III — INDUSTRIAL MACHINERY AND SUPPLIES

The manufacture of machinery is a very important phase of our industrial development since many industries depend upon machines The value of all machinery made in the United States annually is nearly three times as great

[8] Numbers and letters refer to Selected References on pages 420-424

as the value of automobiles and parts. Two classes, electrical machinery and foundry and machine shop products, have a value almost as great as that for automobiles

The making of machinery for use in factories represents a second stage in industry, the first stage is the growth of the industry which uses the machines thus providing a market for them The manufacture of heavy machinery has tended to develop close to the industry using the machinery Massachusetts and eastern Pennsylvania respectively manufacture especially cotton textile machinery and woolen textile machines, Colorado and western Pennsylvania make mining machinery and tools, the southern states specialize in making cotton gins and oil presses, and Michigan, Ohio, and southern New England fabricate machine tools The source of raw materials, power, labor, and transportation are all important, but technical skill and a laboratory in which to try out and perfect the machines are essential Also improvements in machines are likely to be invented by persons watching them work and repairing them.

The six maps here presented bring out in a striking way the relation of the above factors to the distribution of machine manufacturing.

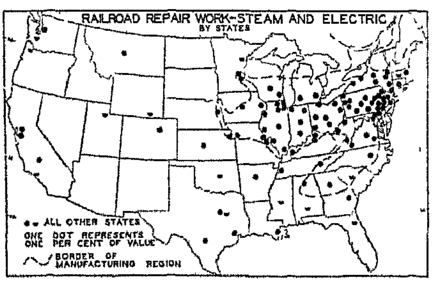



FIG 297. Account for the concentration of railroad repair work in the manufacturing region of northeastern United States.

**Railroad Repair Work.** Of these types of manufacture, the most generally distributed is railroad repair work, both electric and steam (Fig 297). Compare this map with the distribution of population and you will notice that a closer correspondence to population is represented in this industry than in any other machine industry Also, it resembles the railroad map The great railroads place their repair shops near the middle point or ends of their lines. Even so, the manufacturing region of northeastern United States has nearly three-fourths of this work It has the iron and steel, the chief railway network, the great tonnage of freight, and the dense population The value of the repair work on old cars is four times the value of new cars made

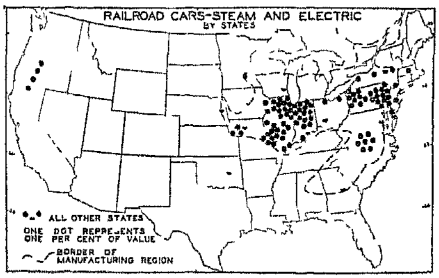



FIG 298 Two states, with great iron and steel industries, ample labor supply, large railway net, great terminal points and rail connections make nearly half of our railway cars Together Maryland, Virginia, West Virginia, North Carolina, and South Carolina make 7 per cent of the cars, California, Oregon, and Washington 4 per cent.

**Railroad Cars.** In contrast to a general distribution of railroad repair work is the concentration in the manufacture of railroad cars (Fig. 298) The four leading states manufacture 71 per cent of the railway cars of the

country An early start, ample iron and steel, location at great railway termini, and easy connections with the chief lines are factors accounting for this distribution of manufacturing Illinois, with the Chicago metropolitan district, leads, having the largest car factories in the world at Pullman, devoted to the manufacture of parlor and sleeping cars. St Louis, the great railroad center for the southwest, ranks high.

**Foundry and Machine Shop Products.** The work done in foundries and machine shops is one of our chief industries, having an annual value greater than the manufacture of agricultural implements, textile machinery, machine tools, railroad cars, and railroad car repairs Foundries cast metals into various shapes, while machine shops with power machinery cut and shape metals into many products They are needed in most districts since both do odd jobs of repair

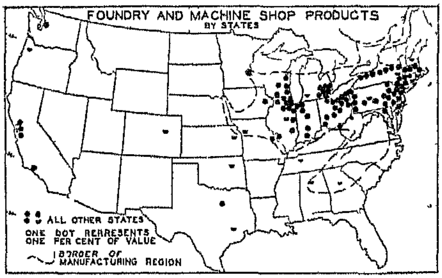



FIG 299 Foundries, according to the census, are plants in which metals are cast into various shapes, and machine shops are those in which tools cut and shape many metal products. The states with no dots have plants of this type, but they are small and manufacture less than 1 per cent of our total

and manufacture many articles used locally (Fig. 299). Yet there is a concentration in the states from Illinois to Massachusetts. Why?

**Machine Tools and Accessories.** More concentrated than that of the other products is the manufacture of machine tools and accessories (Fig 300) This industry is concentrated

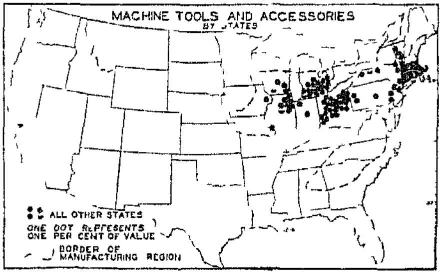



FIG 300 Machine tools embrace power-driven machines which use a tool for work on metals, accessories embrace twist drills, reamers, cutters, taps, dies etc Explain why the industry should be so important in Connecticut, Michigan, and Ohio, Ohio has 25 per cent of the total, Connecticut 9 per cent and Massachusetts 8 5 per cent

in important manufacturing regions that make large amounts of machinery. Machine tools are really basic to modern manufacturing; by them wood, metals, and steel are shaped by simple mechanical processes Planing, boring, turning, and slotting tools simply perform complicated work for hours with little attention from the operator. Steel or brass rods or wire fed into a machine in huge rolls come out as bolts, nuts, screws, or nails by the barrelful, each article a duplicate of the other of its kind The lower lake region, southern New England, and New York are the leading districts. This industry is less dependent upon raw materials and more dependent upon a market and upon the skill and technical knowledge of the workers.

**Electrical Machinery.** The making of electrical machinery is even more concentrated in northeastern United States (Fig. 301). Electrical ma-

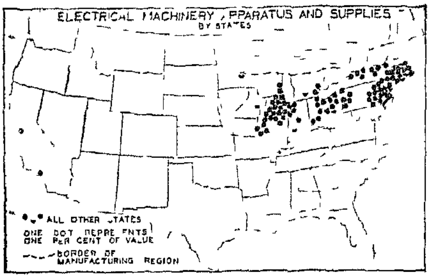



FIG 301 This map represents the factories that make machinery, apparatus, and supplies used to generate store, transmit, and use electrical energy Six states make nearly four-fifths of the total

chines are complicated, though fairly light, and require much skill and a relatively small amount of raw material and fuel. The districts that started this new industry have, through scientific experimentation, made and developed most of the improvements They are made near regions of great water power development where a large use of electricity is also possible

**Textile Machinery** Early textile manufacturing regions developed the textile machinery industry (Fig 302) They show the value of an early start, a highly skilled labor supply, a laboratory for testing the machines, and a nearby market

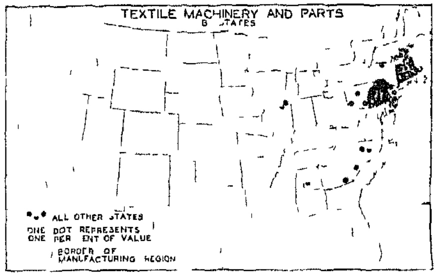



FIG 302 Southern New England and eastern Pennsylvania manufacture four-fifths of our textile machinery, Massachusetts has 33 per cent and Connecticut 6 5

## EXERCISES

1 List separately the different factors that account for the distribution of the manufacturing industries shown in the preceding six maps.

2. (*a*) Summarize the factors that account for the concentration of these industries in northeastern United States (*b*) Compare those with the factors accounting for the distribution of agricultural implement manufacture.

## TWO EXTRA LESSONS

I If you live in a city with a plant of one of the above industries, arrange a field trip to study it Obtain information on the sources of raw materials and fuel, and on the relation of labor, transportation, and market to the industry

II "The shipbuilding industry of the United States" Obtain statistics of manufacturing from the Census of Manufacturing and make a map showing distribution, explain the concentration in three regions and the dominance of the Atlantic seaboard References.

"Shipbuilding on the Great Lakes" — B, VI (1908), 255–261 "Shipbuilding in the United States" — B, XV (1917), 251–258, B, XVI (1918) 349–351, C, XXXIV (1918), 212–229, 23, pp 606–613.

# CHAPTER XXXV

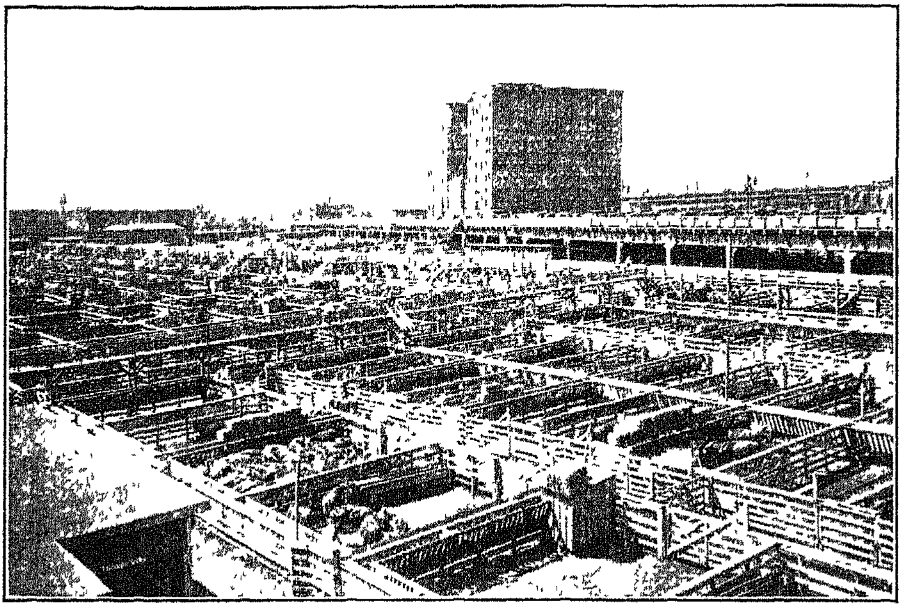
## SLAUGHTERING AND MEAT PACKING

**Butchering on the Farm.** On a certain morning early in November, the first light appears in the window of the house on a huge wheat farm in North Dakota The weather is clear and cold, foretelling an excellent day for butchering the fourteen hogs and one steer that are to become part of the farmer's meat supply for the coming year These animals are sleek and fat, the best of the herd A portion of the barn is cleaned for scalding, scraping, and removing the entrails. The farmer starts a fire near the barn under a huge iron kettle filled with water for scalding

Several neighbors arrive and the butchering starts By six o'clock the hogs are killed, scraped, and cut in half After a hearty breakfast the meat is cut, the fat trimmings are made into little squares, and then rendered into lard in a huge iron kettle out of doors, the lean trimmings are ground for sausage, the heads cooked for head cheese, small intestines and stomachs cleaned for sausage and head cheese containers, tongues and feet cooked for pickling, and the blood prepared for blood sausage. Only bones, hair, and entrails are wasted The women help with the meat cutting and prepare the meals for the workers Late in the evening, after the butchering is finished, all eat a hearty meal and the neighbors go home, each taking a little meat and sausage. Although the main part of the work is finished in a day, several days pass before the farmer and his wife are rested and have things running normally again Soon another farmer butchers and again the neighbors turn out to help

The farmer's family and his help have an ample supply of fresh meat until spring The meat is put in a meat house and kept cool during the winter In the spring the remaining fresh meat is salted, smoked, pickled, fried or preserved in lard Little fresh meat, except chicken, is eaten by the farmer situated at a distance from town during the summer. Many farmers living near towns do not butcher for themselves but buy from the local butcher.

**The Local Butcher.** The local butcher in the village buys hogs and cattle from the farmers He slaughters every other day in a shack-like building located near town, and if possible on a small stream Often waste materials are thrown out and dogs and rats eat them. At times the slaughter house is on the butcher's farm where he has pasture, room, and feed. He may raise some of his own stock, keep pigs to act as scavengers, thus turning part of the waste products of the animals into use The butcher's market is entirely local In winter he puts up enough ice to keep his butcher shop supplied for the whole year unless, as is often the case in later years, he has electric refrigeration. Throughout



*Courtesy of Louis R. Bostwick*

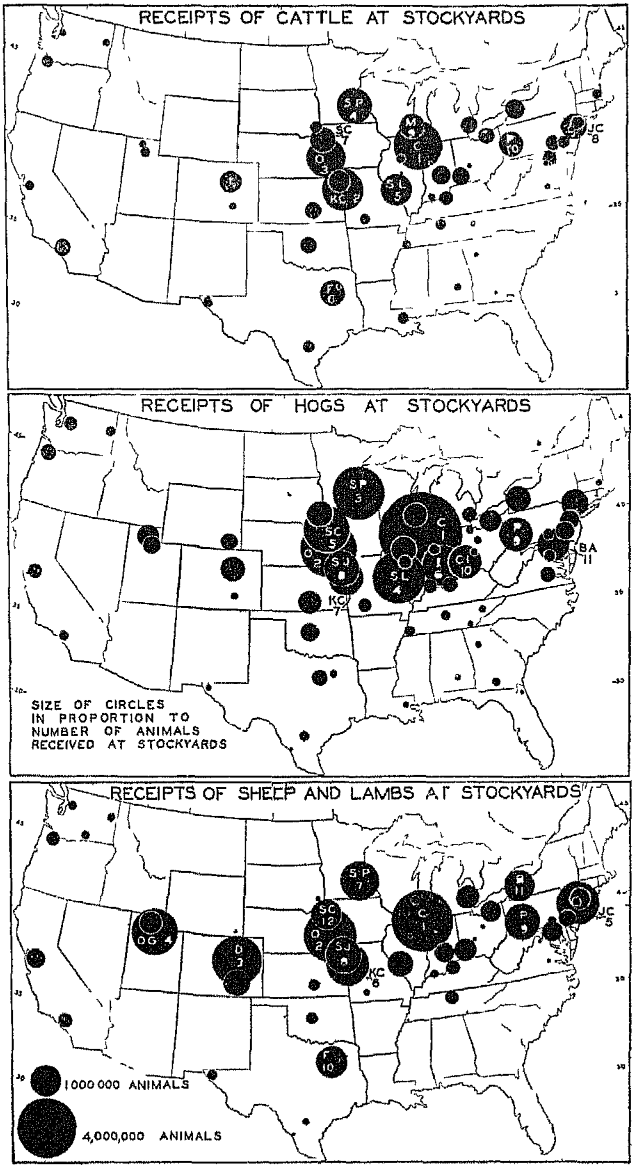
UNION STOCKYARDS, OMAHA, NEBRASKA

FIG 303 A great slaughtering and packing center and a large transshipment point for stock from the Great Plains to the corn belt. The packing plants adjoin the stockyards

the Middle West and South many villages have a local butcher.

**The Meat-Packing Industry of the United States.** With the concentration of population in certain sections and the concentration of cattle and hog production in other sections, the shipment of meat from regions of production to regions of consumption became necessary (p. 72). There were two methods of shipment — either live animals or dressed meat. Before refrigeration animals were shipped to local butchers or packers, but later animals were slaughtered in large centers and sent to the consumers (Fig. 303) Whereas the local butcher in the slaughtering of a pig does all the work himself, in the huge packing plants a hundred people are involved in butchering one hog. In the large packing plants sanitary conditions are maintained under the direction of government inspectors who examine the meat from the time the animals arrive at the stockyards until they are cut up. Nothing is wasted As a local butcher once said when speaking of the keen competition of the packers, "They can use every part of the hog except his squeal." The large packer ships to all parts of the United States and markets his product through branch houses.

**Westward Movement of the Packing Industry.** The first packing industry developed as early as 1662 in Springfield, Massachusetts. The meat was sent to market in Boston and much continued on to the West Indies. The Dutch in New York and settlers in Pennsylvania and Virginia also developed local centers. The packing industry followed the migration of




SLAUGHTERING AND PACKING CENTERS

FIG 304. The numbers on the maps show the rank of different centers in the receipts of livestock C, Chicago; O, Omaha, K C, Kansas City, Missouri, St P., South St Paul, S L, East St Louis, J C, Jersey City, S J, St Joseph, P, Pittsburgh, F, Fort Worth, B, Buffalo; Ba, Baltimore; I, Indianapolis, Ci, Cincinnati; S. C, Sioux City; Og, Ogden; D, Denver, M, Milwaukee. Pick out different centers and explain their rank — Ogden, Buffalo, etc.

Note the relation of the receipts of cattle to the corn belt, to the grazing lands of western United States, and to the market areas for meats (page 72). Compare the maps page 202 and the one of receipts of swine Explain the distribution of the centers for the receipt of sheep and lambs.

population westward By 1818 Cincinnati had become the greatest meat-packing center in the country Ohio, Kentucky, and Tennessee remained the dominant section until after the Civil War Plentiful supply of cheap land for cattle and large quantities of nuts, berries, roots, and corn for hogs made stock raising easy As people moved westward the industry developed in Indianapolis, East St Louis, Chicago, Kansas City, Omaha, Sioux City, St Paul, and Fort Worth (p 375) Rail facilities and other advantages soon gave Chicago an opportunity to surpass all other centers (Fig. 304)

**The Growth of the Industry in the Middle West.** In the early meat-packing industry hogs were the chief animal packed, while beef remained almost entirely an industry handled by the local butchers who sold fresh meat For the pioneer, the hog is the meat animal *par excellence* It eats anything from nuts and roots to table waste from the house It thrives on corn, the ideal pioneer crop The hog reproduces rapidly and the pigs attain full growth in less than a year A hog can take care of itself against such enemies as snakes, wolves, and dogs A large portion of the hog is edible and because of his moderate size is easy to butcher by the individual farmer Among its greatest assets to the farmer as well as to the packer is the hog's suitability for preservation in many forms that can be shipped long distances to consumers This was not true in the early days in the case of beef.

As pork packing early represented the major portion of meat packing, it is logical that the industry should grow up in the corn belt where most of the hogs are raised With this early start and the later development of beef packing, the principal packing plants are between the great producing and consuming centers It was more practical to ship dressed meat than livestock because of the lighter weight of the dressed animal and the smaller loss due to the strain of a long haul on live cattle and hogs If stock were driven to market the loss was even greater and the meat poorer The introduction of refrigeration cars by the Chicago packers solved the big difficulty of getting the dressed meat to the market in good condition

The large local markets, such as Chicago, helped to absorb meats difficult to pack, such as spare ribs and backbones Chicago and other cities became railroad centers and hence had excellent facilities for getting the livestock and shipping the meats Corn-fed beef from the western packers was much superior to the eastern beef, which was often made from old dairy cows The firm, tasty flesh of the corn-fed hog surpassed that of the waste-fed eastern hog The western pioneers were greater meat eaters than their eastern cousins because they lived more actively out of doors and because fish were not as easily obtained as on the seaboard

The cool climate of the northern section was more favorable for an industry of this nature than was the region farther south because of ease of handling meat in the cold seasons and ability to secure ice in winter to be used in the summer. The growth of large plants in the West was further accentuated by the utilization of by-products to increase the profits of the organizations Perhaps it would not be fair to leave out of consideration

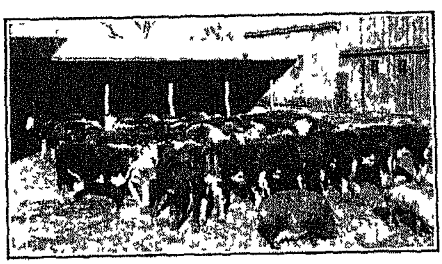
the great pioneers of this section whose foresight guided these enterprises to great importance Swift, Armour, and Morris, as well as Edward and Michael Cudahy, are men whose active pioneer work made them captains of what was for a long time America's leading industry

In spite of many advantages, the early mid-west packer had many grave problems to solve Among these was the difficulty of overcoming the local butcher's objections to his slaughtering beef which up to this time had been entirely in the hands of the local butcher. The local meat markets refused to handle the packer's beef, telling eastern customers that western meat was inferior They even went so far as to get laws passed which made it impossible for the westerner to ship beef to certain sections for sale To overcome this opposition Swift took into partnership the leading butchers of most of the large consuming centers Armour established branch houses in the larger centers to meet the same problem. Later Swift adopted branch houses The consumer soon learned that western beef was excellent

A second problem was the opposition of the railroads Since a dressed animal weighs only from 55 to 70 per cent as much as a live animal and since the railroads were paid for transportation by the pound, they stood to lose a tremendous volume of business. The packers overcame the difficulty by paying a higher freight rate on dressed meat Then the refrigerator car problem arose, the railroads refusing to build cars for such a specialized trade, so the packers built their own cars and not only shipped meat in them but used them profitably for carrying fresh fruit and vegetables.

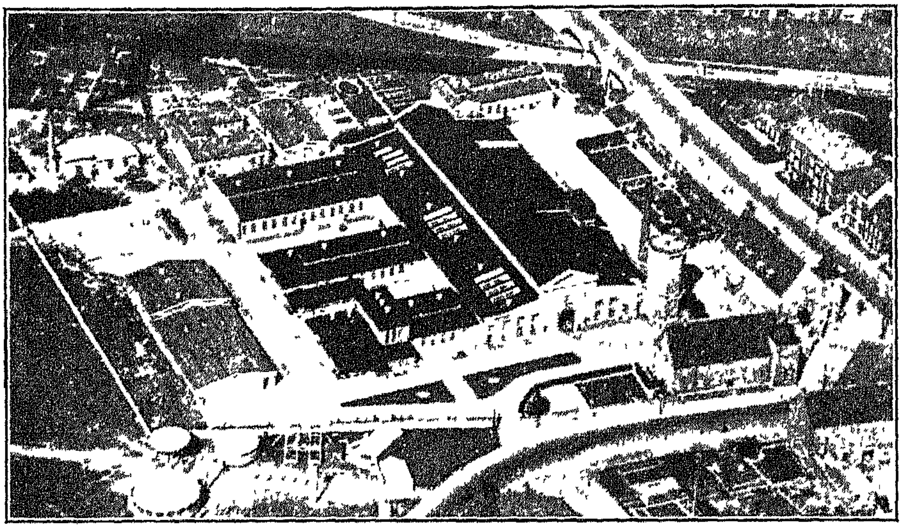
Even after these adjustments to establish the packing industry, there were still other problems to be solved. The fluctuation of the demands of consuming centers caused by sudden hot spells of weather, return of fishing fleets, and opening of game seasons, required careful adjustment of purchases of live animals to possible sales. The opposition of the people to what they called the packing trusts caused a good deal of trouble Finally the transfer of much foreign trade to Argentina has caused considerable loss to the industry

**The Story of Meat from Ranch to Retailer.** For two full years the rancher grazes his animals on the open range (pp 70 and 72). They are never fat but as long as they have plenty of feed to make them grow, the corn-belt farmer is satisfied to buy them, for he can put fat on a healthy steer much more rapidly and at much less cost, feeding him corn, than can the rancher feeding him hay The meat from corn-fed cattle is better than any other kind So in the summer or early autumn the corn-belt



A Herd of Hereford Steers

Fig 305 Hogs and cattle are fattened on corn, thousands of cattle from the Great Plains are brought into the corn belt for fattening, nearly two-thirds of our corn crop is fed to hogs and cattle Cities in the corn belt are the great slaughtering centers of the country



Nordisk Luft-Foto

AERIAL VIEW OF ODENSE BACON FACTORY, DENMARK

FIG 306 Explain why the little country of Denmark leads the world in the export of bacon

farmer buys cattle from the West He also raises or buys a number of hogs for feeding with the cattle (p 203) By February or March the cattle and hogs are fat and ready for the market (Fig 305) They are shipped to one of the central markets such as Chicago where they are immediately examined by government inspectors to see that they are free from disease. Buyers for the packing plants then pick out the animals they want.

The animals are driven into the packing plant, slaughtered, and prepared for canning, curing, or sent to the refrigerator to be chilled and await shipment. Fast through trains of refrigerator cars distribute the meat to the branch houses of the company From these branch houses local trains or trucks deliver the meat to the local markets. In this way even the small meat markets can get a regular supply of fresh meats for their customers. The efficiency of the great packing companies in preparing and delivering meats and the wide use of automobiles have caused thousands of farmers to cease killing their own meat supply and to buy as they need from the local village markets

**Meat Packing in Other Lands.** Review the conditions favoring the grazing of beef cattle and mutton sheep in southern South America (pp. 74 f. and 76 f ) In spite of the excellent physical conditions in this region, practically no meat was shipped to the world markets until after the introduction of the refrigerator ships in 1877. What products came from this region before that date? The introduction of refrigeration caused the building of several huge packing plants, equipped with modern conveniences on the coast or rivers from southern Brazil to Patagonia. Fat steers move only a short distance by rail to packing plants. After the animals are killed as they enter the plant,

the carcasses do not stop moving until they are carried on an endless belt into the cold storage room of a great steamship that transports them to northwestern Europe

Although physical conditions favor the production of hogs, few are packed because of (1) lack of demand for pork by Argentine consumers, (2) necessity for expensive woven fences, (3) greater amount of labor required to care for hogs in this region where labor is not plentiful, and (4) many swine diseases in a new region.

Review the conditions favoring the grazing of cattle and sheep in Australia and New Zealand (pp 77 f and 79). In addition to these a high class of people, modern slaughtering and refrigerating plants, and commercial ties with the British Empire cause these areas to rank high in the meat trade of the world.

Because of excellent physical conditions, cheap production, excellent stock, and nearness to the sea Argentina, Uruguay, and south Brazil are able to supply nearly two-thirds of the world's export of beef, most of which is consumed in the United Kingdom and west central Europe The superior physical conditions for sheep raising in New Zealand enable that country to furnish one-half of the world supply of mutton, whereas Argentina supplies one-fourth of it. Most of the mutton export goes to the United Kingdom and France

Although the United States produces two-thirds of the corn of the world, she exports very little Forty-one per cent of the corn crop is fed to hogs which means that the United States far outranks any other country of the world in hog production (p 202). As a result the United States leads in the export of pork from the lard type hogs Denmark and the Netherlands supplement their dairying by producing hogs of the bacon type which do best on skim milk as part of their diet (Fig. 306). United Kingdom and Germany are the major pork markets of the world.

## EXERCISES

1. (*a*) What reasons can you give for many farmers killing their own meat? (*b*) Why do so many villages have a local butcher?

2. Why did meat packing start in the eastern states and then migrate westward?

3. (*a*) List several factors to explain why meat packing is most important in the corn belt. (*b*) Why is Chicago the leading packing center in the world?

4. (*a*) Explain why southeastern South America ships nearly two-thirds of the beef exports of the world (*b*) Why do New Zealand, Australia, and Argentina together supply nearly 90 per cent of the world's exports of mutton? (*c*) Why does the United States lead the world in the export of pork products?

5. Explain why northwest Europe imports most of the world's exports of meats.

## TWO EXTRA LESSONS

I. "Sugar Refining in the United States" — 12, pp. 121–123; 90, Chapter XI; 20, II, Chapter V; 41, pp. 55–69.

II. "Flour Milling in the United States" — From the census obtain figures on flour milling and make a map showing with dots by states the percentage of our total production; explain the distribution of flour mill-

ing — 1, pp 322–324 3, pp 111–128, 7, I, Chapter XXXII, 9, pp 37–43, 12, p 244, 13, pp 53–59, 20, II, Chapter VII, A, III (1927), 391–396, A, VIII (1932), 81–93, 24, pp 29, 49

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"The Meat-Packing Industry" — B, XXVI (1927), 342–350, 77, Chapter XII, 87, pp 303–306, 12, pp 247–257

"Slaughtering of Cattle, Hogs, and Sheep" — 9, Chapters X, XI, and XII

"A Modern Packing Plant" — 31; 20, II, Chapter X, 9, Chapter X, 21, III, pp 99–123

"Hog Production and Marketing" — 106 (1922), pp 181 ff (advanced and technical)

"Our Beef Supply" — 106 (1921), pp 227 ff

## TOPICS FOR INVESTIGATION AND REPORT

"Why Chicago is the World's Largest Meat Packer" — 1, 25–32, 9, Chapter X, 77, pp 262–272

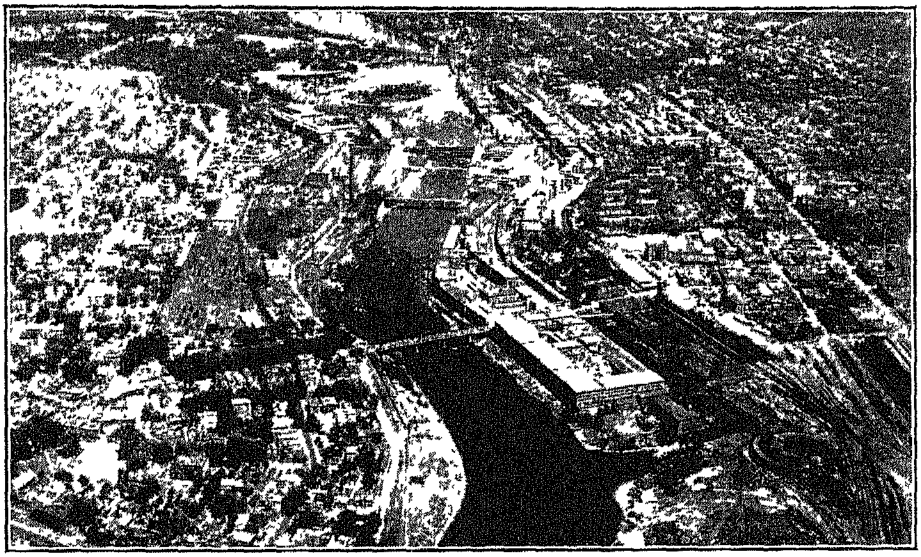
"The Westward Movement of the Slaughtering Industry" — 77, Chapter XI, 106 (1922), pp 186–192, 106 (1921), pp 232–239

"Modern Methods of Marketing Beef Cattle" — 106 (1921), pp 277–290.

"Grades of Beef-meat" — 106 (1921), pp 308–312

"Trends in Consumption of Beef" — 106 (1921), pp 312–317, 23, pp. 159–161, 24, pp 173–187

[1] Numbers and letters refer to Selected References on pages 420–424



Courtesy of Fairchild Surveys, Inc

FIG 307 THE GREAT TEXTILE MILLS ALONG THE MERRIMAC RIVER, MANCHESTER, NEW HAMPSHIRE

# CHAPTER XXXVI

## THE TEXTILE INDUSTRIES

From early times peoples in every continent made clothing from various fibers In eastern Asia, silk and cotton were used, in India, cotton, in western Asia, wool and linen, in Egypt, linen and cotton, in Europe, wool and linen, and later silks and cotton, in the Americas, wool and cotton. The fiber to be spun was held on a distaff and the thread twisted by hand and wound on a spindle. The spinning wheel was used in eastern Asia and in several parts of Europe as early as the fifteenth century and was later taken to many regions by European colonists The thread was woven into cloth in hand looms in the homes. Some workers were spinners and others weavers. By the middle of the eighteenth century spinning and weaving were household industries throughout the Western world This method is still used by many primitive peoples, but most of our textiles today are made in large modern factories (Fig. 307).

The great change from hand-made textiles to machine-made fabrics developed first in England because of a number of factors The insularity of England permitted a long peaceful development during the Middle Ages when much of Europe was involved in wars. Freedom from war caused many artisans, merchants, and weavers to migrate from the mainland and settle in England. Excellent ports favored early maritime development and the expansion of the English into new lands.

The cool damp climate and rough grazing lands of western England favored the raising of sheep The people needed warm clothing With peace, much wool, and time for manufacturing, these people made clothes for themselves and for eastern England With the development of commerce they were able to export clothing to other lands With a growing market they improved their methods and invented machines to increase production. At first the spinners and weavers worked in their own homes, later several hand looms were put in one room and weavers came in to use them

Under these conditions the English made many inventions that changed the manufacturing of textiles. First came the "fly shuttle" (1738) which made it possible to weave wider cloth and do it more quickly This created a demand for more thread Then came Hargreaves' carding machine (1760), and his spinning jenny (1764), the spinning jenny of Arkwright (1767) and Arkwright's water-frame (1768), all speeding up the spinning process for coarse thread Then followed Crompton's mule spinner (1779) which produced a strong fine thread and could do more work than a hundred workers at the spinning wheel One invention led to another With these spinning machines the weavers could not keep up In 1785 Cartwright invented the power loom run by water power and by the steam engine (invented by Watt in 1769) Spinning machines demanded weaving machines and these demanded more wool and cotton In 1789 Cartwright improved the wool combing machines and in 1793 Whitney gave us the cotton gin This made cotton cheap To the preceding factors should be added the humid air of western England which decreased the breaking of threads, the large amount of pure water for washing and bleaching, and nearby deposits of coal, iron, and salt beds to fully understand the great expansion in the manufacture of textiles by machines in the western part of England

## § I — COTTON TEXTILE INDUSTRY OF THE UNITED STATES

One of our leading manufacturing industries is the cotton textile industry which employs half a million workers in fifteen hundred cotton mills located in eastern United States (Fig 308). In this region two districts lead, southern New England and the southern Appalachians.

**The Growth of the Cotton Textile Industry in Southern New England.** Many factors favored the establishment and development of the cotton textile industry of southern New England.

**An Early Start.** Before the use of machinery, woolen and cotton textiles were made by hand in New England The wool was produced at home or imported; the cotton came from the West Indies. England so zealously guarded its new machines that even the baggage of people leaving England was searched to prevent any plans of the machines from getting into a new country. Samuel Slater, a young man who had worked with Arkwright, came to America He made the machines from memory and built a small

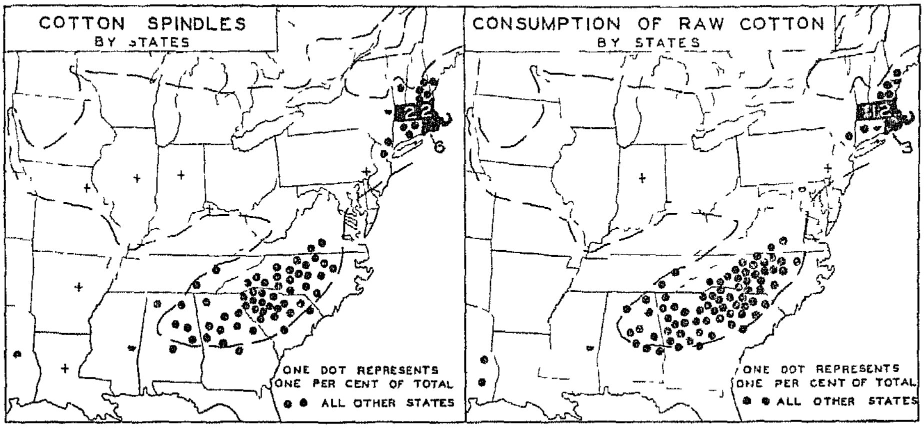



FIG 308 Southern New England and the southern Appalachians have 94 per cent of our cotton spindles and consume 94 per cent of the cotton used in manufacturing in this country The dash line represents the border of the manufacturing regions of east central North America States with crosses have less than one-half per cent

factory in 1790 at Pawtucket, Rhode Island — the first factory in America to contain machines. The Revolutionary War, wars in Europe after 1800, and the War of 1812 interfered with the commerce of New England merchants and made it difficult for our people to obtain cotton goods from England This favored manufacturing in New England Slater's experiments and those of others soon showed that New England had excellent conditions for the cotton textile industry.

**Capital.** Capital for new, small mills with only a few spindles and looms was obtained at first from merchants and seamen whose business was interfered with by wars They had put considerable sums into a single shipping venture before and had waited a long time for profits, so they were not afraid to risk investment in new cotton mills. Later the rich whaling industry supplied capital for the new mills and the profits were reinvested to further develop the industry By 1830 many merchants of Boston and New London owned shares in cotton mills As the early mills were located in rural districts, they paid no municipal taxes for decades and other taxes were low

**Labor.** Poor farm land, long winters of little farm labor, and stimulating climate caused the farmers and their women folks to develop home industries These same conditions made them glad to obtain work in the new mills where, in the early days, two-thirds of the laborers were women who had already developed skill in spinning and weaving. The opening up of the Middle West after the War of 1812 and the completion of the Erie Canal in 1825 allowed foodstuffs to come in from the West and caused many New Englanders to give up farming and turn to the mills for work After 1830 conditions in the United Kingdom caused many Irish and others to seek work in New England mills. Later, French Canadians added excellent workers to the labor supply. Thus a supply of skilled laborers was available at small wages for the cotton mills

**Water Power.** The use of machin-

ery in the mills required more power than men or animals could supply Water power sites, already widely used in southern New England for grist and sawmills, were readily used by the new cotton mills Hundreds of rapids and falls on the many small streams provided favorable sites, for the bed rock, boulders, and huge timbers made their use fairly simple, as the early mills did not require the use of huge

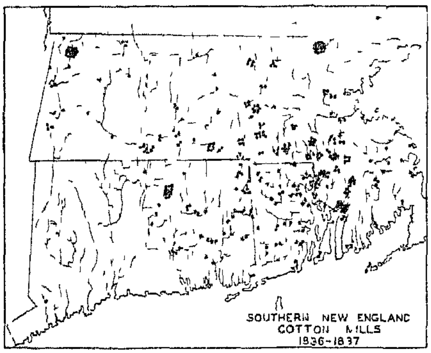



FIG 309 The influence of water power and much pure water is strikingly shown by the location of the cotton mills in southern New England in 1836 before steam power was introduced The many lakes and ponds afforded ample pure water for mills on streams for washing bleaching, and dyeing

falls A small stream in the country was an ideal site (Fig 309) The maximum flow of the streams came in spring and early summer during the period of greatest activity in the mills However, the mills soon outgrew the small sites and huge mills were built at large falls and at coastal points where coal was received by sea Also after 1850 many mills added steam power to supplement water power By 1880, 43 per cent of the power used in the New England cotton mills was steam power and by 1900 it was 66 per cent.

**Climate.** A long winter season caused people to seek work in factories and the changeable climate stimulated them to work The fairly even distribution of precipitation throughout the year favored the development of water power The high relative humidity — in other words, the moist air — permitted the spinning and weaving of threads by machines without much breaking This was especially important before artificial humidifiers were installed Also, the cool changeable climate required much clothing and thus insured a good market

**Transportation and Market.** A great extension of turnpikes and roads favored the building of mills on inland streams Numerous canals were completed, soon followed by many short railway lines In addition the entire region was near the sea, by which came the cotton and later the coal The rapid increase in population in this country demanded more and more cotton textiles, while exports steadily increased

**The New England Cotton Textile Industry Today.** Though the southern states now outrank New England in the number of spindles, the consumption of cotton, and the value of cotton textiles manufactured, the cotton textile industry is still a leading one in New England Though hundreds of small mills have closed, their dams having fallen to pieces, and their buildings having been burned or wrecked, New England still has the greatest cotton mills and the largest textile towns The change from direct water power to steam power caused a concentration of the mills near the seaboard Now the mills are changing to electric power, generated by water or coal Electric power is re-

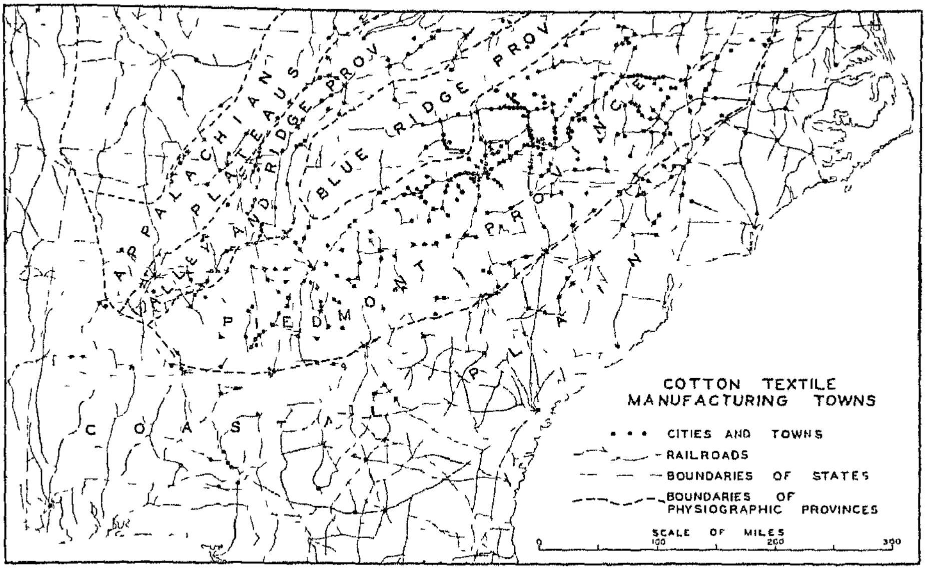



FIG 310 In the southern Appalachians the piedmont and the valley and ridge province have the greatest number of textile towns, the piedmont has nearly two-thirds of the total mill towns This map shows that the towns have rail transportation, most of the mills in them are located on or near streams

liable, convenient, and economical A network of power lines covers New England, supplying three-fifths of the power used in the cotton textile industry of that section The chief advantage held by New England today in the cotton industry lies in the skill of its laborers and the experience gained through long years in the business. The goods are high-grade textiles and specialties — small wares, elastics, and mixed fabrics — whose value depends to a large extent upon the skill and labor required in making them The mills are near Boston and New York, the chief centers for the distribution of textiles to domestic and foreign markets, they are in one of the great regions of textile machinery manufacture (p. 372)

**The Advantages for Cotton Manufacturing in the Southern Appalachians.** In recent years the southern states have definitely passed New England in number of spindles, consumption of raw cotton, and value of cotton textiles

**Raw Cotton.** In the inception and early development of the cotton industry in the southern Appalachians a supply of raw cotton at hand was a distinct advantage. In the low-grade cheap goods of the early southern mills, raw cotton represented a larger percentage of the cost of the finished article than was the case in the higher-grade textiles and specialties of the northern mills. As the industry developed and improved the mills drew more of their cotton from the western cotton regions (p. 193). Now they get nearly half their cotton from the regions in the western part of the cotton belt, and the freight rates on this cotton are about the same as those on cotton from Texas to New England However, much cotton is hauled by wagon and truck from the farms to

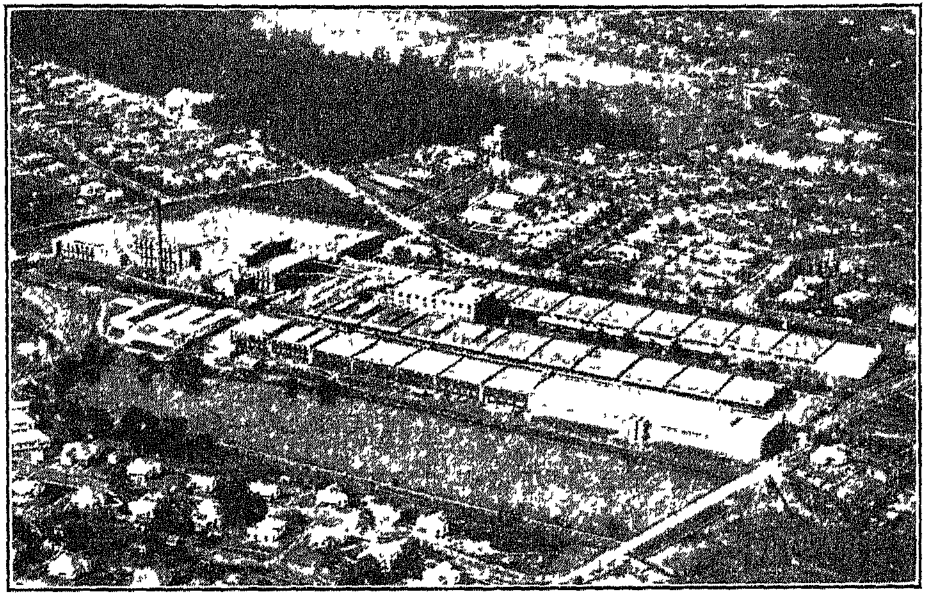
the doors of the mills in the southern Appalachians

**Power.** The cotton mills of the southern Appalachians have cheap electric power generated by water or coal, while some of them use direct water power The coal comes only a short distance from the middle and southern Appalachian coal fields (p 326). Most of the mills lease electric current cheaply from large power companies that have connected the many waterfalls with super-power systems and covered the entire region with a network of power lines Power development is favored by many streams with falls and rapids in their drop from the high lands to the coastal plain, and the regular flow of the streams as a result of fairly even distribution through the year of heavy precipitation (p. 189) Though the cost of power represents only a small part of the cost of finished textiles, cheap power is essential to the great development of the southern mills

**Capital and Taxes.** For the expansion of the industry capital has been plentiful. It has come from local sources, stockholders in the northern states, textile companies in New England that established branch plants, and from profits of the southern mills. Cotton manufacturing is carried on in small villages or towns for the most part as it was in New England in the early days of the industry (Fig. 310) These small mills pay very small or no municipal taxes. Some of the large towns in order to attract cotton mills provided land at cheap prices and freed the company of municipal taxes from thirty-three to ninety-nine years. Here the mills have to carry a smaller portion of the total tax burden because of more and better farm land in these states than in New England In Massachusetts in recent years taxes have amounted to 75 cents per spindle, in the southern mills the taxes, on the average, are only a fraction of that

**Abundant and Cheap Labor.** Before the establishment of mills in the South, people in the southern Appalachians spun and wove their textiles by hand, as a few still do Thus they knew the process Until recently the southern mills in comparison to the mills in New England have enjoyed a differential of 30 per cent in the cost of labor because of lower wages and longer working hours. Living in the mountains in rather poor farming country, the people have been glad to flock to the mill villages and towns for permanent work and better living conditions. Most of the heavy work about the mills is done by colored laborers but the work in the mills is done by white workers Though they lack the skill of the New England laborers, in the manufacture of coarse goods they are just as efficient as the makers of higher-grade textiles in New England mills

The laborers can afford to work for less wages than those of New England mills because of the low cost of living which is due chiefly to climatic conditions The long growing season and nearness to sources of supply make it possible for a southern laborer to obtain his food for 20 per cent less than the worker in the large manufacturing towns in New England. As the winters are short and mild, he uses little fuel and needs less heavy, expensive clothing. Also many of the laborers live in company houses with garden spaces for each house and they pay on the average only half the rent that



*Courtesy of Callaway Mills*

FIG 311 AERIAL VIEW OF CALLAWAY MILLS, LA GRANGE, GEORGIA

laborers in New England have to pay (Fig. 311). As the cost of labor represents the chief item in the cost of finished cotton textiles, this difference has been the chief advantage of southern mills.

**Transportation and Market.** The region has a network of railways and motor roads that serve all the mills. The growing commercial centers of the South and New York serve as the distributing points for an expanding market The region is near the center of population of the country, which is in Indiana. The region produces most of our coarse-grade textiles and recently is bleaching, dyeing, and finishing many high-grade products. Cotton mills are expanding into the western part of the cotton belt. More will develop there and in the Ozark region.

EXERCISES

1. (*a*) Explain how textiles were made before the invention of machinery (*b*) Why did the change from hand-made to machine-made textiles first develop in England? (*c*) List the English inventions that aided the textile industry with the inventor, the date, and the process performed by the machine.

2. (*a*) What two regions manufacture most of our cotton textiles? (*b*) What percentage of our spindles and cotton consumption in manufacturing does New England have? (*c*) Outline in detail the conditions that favored the great development of cotton textile manufacturing in New England (*d*) What advantages has New England today?

3. (*a*) What percentage of our cotton spindles and cotton consumption in manufacturing do the southern Appalachians have? (*b*) Outline in detail the advantages the southern Appalachians have for manufacturing cotton textiles (*c*) Which region specializes in high-grade goods? (*d*) Which makes most of our coarse-grade fabrics?

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"Making Textiles by Primitive Hand Methods" — **85**, pp 144–148

"History of Cotton Manufacturing" — **4**, Chapter XIX, **77**, pp 288–308, **23**, pp 516–521

"What Happens in a Cotton Mill" — **4**, Chapter XVIII, **25**, III, Chapter X, **7**, I, Chapter XVIII, **10**, Chapter VI

"The Textile Industries in the United States" — **B**, XXVII (1928), 331–340, **20**, II, Chapter XIII

"Cotton Manufacturing in New England" — **4**, Chapter VI, **95**, pp 99–101, **77**, pp 288–328, **A**, IV (1928), 74–87, **64** (authoritative but difficult), **12**, pp 286–289, **10**, Chapter V

"Cotton Manufacturing in the South" — **4**, Chapter VII, **1**, pp 74–77, **95**, pp 102–103, **77**, pp 329–364, **A**, IV (1928), 74–87, **A**, IV (1928), 232–240, **B**, XXVI (1927), 1–11, **12**, pp 289–294, **78** (rather difficult reading), **59**, Chapter VII

"Our Markets" — **59**, pp 150 ff

## TOPICS FOR INVESTIGATION AND REPORT

"The Invention of Machines and the Development of the Textile Industry" — **4**, pp 164–175, **77**, pp 288–291, **23**, pp 516–519.

"The Extension of Cotton Manufacturing" — **23**, pp 527–530, **59**, selected portions, especially Chapters I, III, IV, VI and VII

## § II — OTHER COTTON TEXTILE MANUFACTURING REGIONS

Note on the cotton map (p 389) that most of the world's cotton is grown between 35° N and S latitude Figure 312 shows that two-thirds of the raw cotton is manufactured in regions north of 35° N latitude Areas in Europe manufacture 41 per cent, Japan 10 per cent, and New England and the northern portion of the southern Appalachians 15 per cent New England and European areas draw upon many regions for their cotton but the bulk of it comes from southern United States, Egypt, and Africa (p. 195) Where does Russia get much of its cotton (p 391)?

**Cotton Textile Manufacturing in Europe.** Though Europe produces very little cotton, it uses in its factories 41 per cent of the world's supply and has three-fifths of the cotton spindles of the world (Fig. 313)

Review the conditions which favored the early development of the textile industry in western England (p 382) Today Lancashire is the leading single textile region of the world Formerly it made all grades of textiles, but now it specializes in high-grade textiles This region early had a world-wide reputation It developed most of the textile machines and modern methods whence they spread to all the new regions Local conditions are especially favorable in this region (Fig 314). The many streams on the west flank of the Pennines provide numerous water power sites They provide from the sandstone and moorland areas of the Pennines the large quantities of pure water needed in the bleaching, dyeing, printing, and finishing mills. The Lancashire coal fields to the north of Manchester supply excellent cheap fuel

[1] Numbers and letters refer to Selected References on pages 420–424

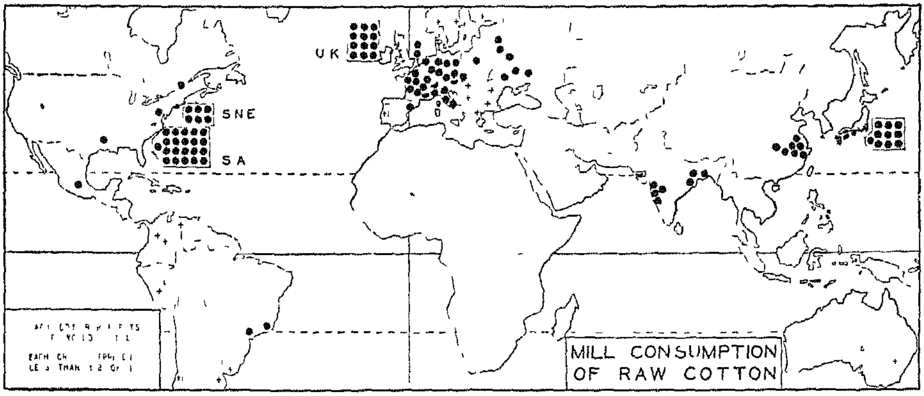



FIG 312 Europe and east central North America consume in their textile mills about 73 per cent of the raw cotton of the world Compare the percentage of world consumption of raw cotton in mills with the percentage of spindles in the United Kingdom Explain the difference

and by-products for bleaching and dyeing The great salt deposits southwest of Manchester furnish chemicals for bleaching, dyeing, and finishing The humid air facilitates spinning and weaving The Manchester ship canal and the location on the west of England favors the receipt of the raw cotton and the export of the finished products. The region has millions of skilled laborers and a great commercial organization that promotes every branch of the industry and has trade connections with all parts of the world

Cotton manufacturing is one of the leading industries of the United Kingdom.

Figure 315 shows that the mainland of Europe has many cotton textile manufacturing districts scattered from the English Channel to Russia and from northern Italy and Spain to Sweden and Finland All these areas, however, have fewer spindles than the United Kingdom (p 389: United Kingdom 34 per cent of world's spindles and mainland of Europe 29 per cent). The mills in these areas consume nearly 30

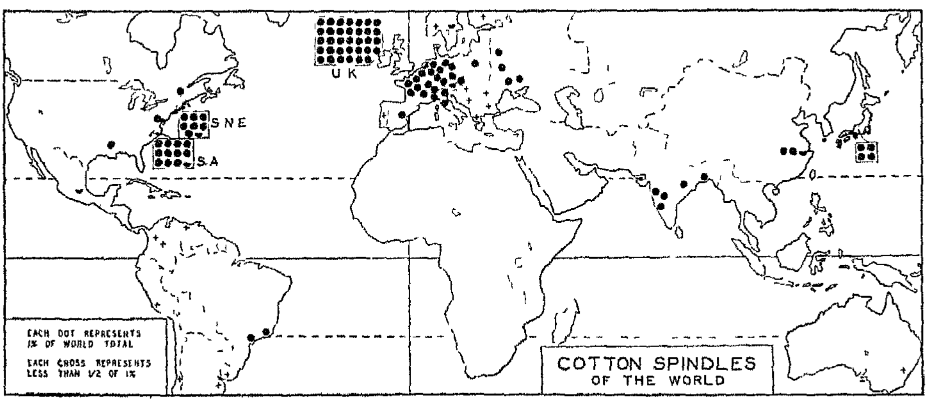
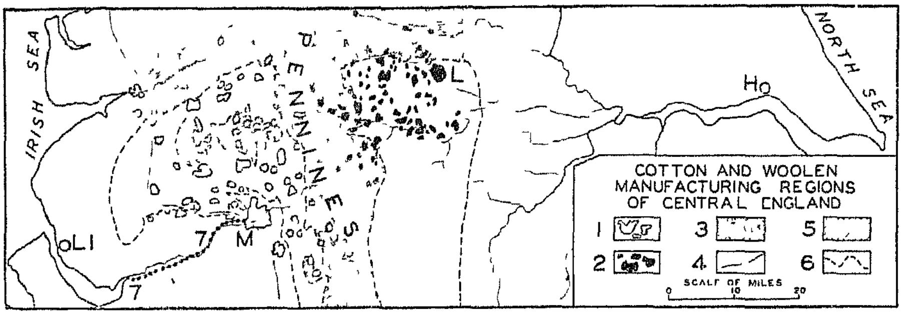



FIG 313 Europe and east central North America have 84 per cent of the world's cotton spindles Compare the percentage of world spindles in Japan with the percentage of raw cotton consumed in Japan, explain the difference



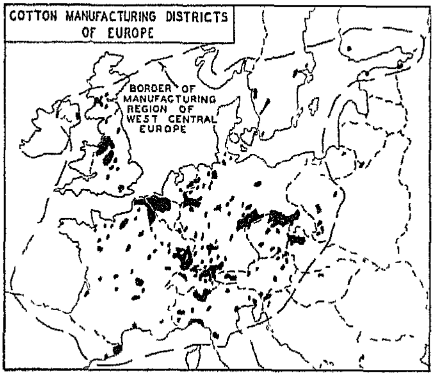

COTTON AND WOOLEN MANUFACTURING TOWNS OF CENTRAL ENGLAND

FIG 314 1, Cotton manufacturing towns 2, Woolen manufacturing towns 3, Millstone grit 4, Western border of soft water 5, Salt beds 6, Border of coal fields 7, The Manchester Ship Canal Li, Liverpool M, Manchester L, Leeds H, Hull Several conditions favor the manufacture of cotton and wool in these regions Many small streams bring down soft water from the areas of millstone grit, the streams are used for power How do the following help the industry coal salt field, location near the Irish Sea, the Manchester Ship Canal, the moorlands of the Pennines?

per cent of the raw cotton of the world whereas those of the United Kingdom manufacture only 12 per cent. Mills manufacturing coarse goods use much more cotton per spindle than those making fine textiles. Many of the continental areas produce coarse goods almost entirely while others produce the finest types of fabrics. Switzerland, France, and Belgium are especially noted for their fine textiles and specialties — laces, ribbons, hosiery, etc.

Most of these areas have manufactured cotton goods for a long time. The areas in Belgium, France, Switzerland, and some of those in Germany are among the oldest districts in the world, in fact they had hand industries before machines were invented. On the other hand nearly every district has shown an expansion since the World War. Each country has tried to produce its own requirements and also some for export. Tariffs, bounties, and other governmental aid have encouraged the advance in the small areas The development of water power, cheap labor, and long working hours also have been significant factors.

The great concentration of cotton textile manufacturing on the Continent is in the central part of the great manufacturing region of Europe (p 337). Six countries — France, Belgium, Holland, Germany, Poland, and Czechoslovakia — have nearly two-thirds of the spindles of the mainland and consume nearly 60 per cent of the raw cotton manufactured on the mainland.




*After Jonasson*

FIG 315. Most countries of Europe have a cotton textile manufacturing industry The chief regions lie in the central portion of the great manufacturing region of Europe Compare the coal and iron regions of this area (p 350) with the cotton textile regions.

The cotton industry in these areas has been favored by an early start, ready access to the sea for the importation of raw cotton, a dense population providing a large home market and skilled cheap labor, the development of foreign markets in colonial possessions and other countries, the large use of water power and coal, much pure water for dyeing and bleaching, and an excellent transportation network of canals, rivers, and railroads

Western Russia has 14 per cent of the spindles on the mainland and consumes 20 per cent of the cotton. It has a large market, cheap labor, cheap water and coal power, and large supplies of raw cotton from areas west and east of the Caspian Sea (p 195). Northern Italy ranks high in cotton textile manufacture because of an early start, the great development of cheap water power, an active home and foreign market, and abundant skilled cheap labor

**Recent Migration of the Cotton Manufacturing Industry into New and Warmer Areas.** A map giving cotton consumption in modern factories fifty years ago would show that nearly all of it was manufactured in east central North America and west central Europe. Since then a great migration of mills towards warmer areas and into cotton-producing areas has taken place. Cotton-growing areas that manufacture textiles include southern United States, southern Japan, India, China, Brazil, other South American countries, and Mexico

Egypt and Peru are the only important cotton-producing countries that do not manufacture large quantities In their desert climate with irrigation, both produce long-fiber high-grade cotton not especially suitable for the cheap clothing demanded in these countries However, this cotton is in great demand in Europe and the United States for high-grade textiles Egypt and Peru have cheap labor of a good quality, but they lack coal and developed water power The extreme dryness of the air handicaps cotton manufacturing Also, in Peru the bulk of the population living in the cold highlands requires warm woolen clothing India manufactures about half its cotton and ships the remainder to Japan and European countries

The largest developments in new regions have occurred in India, Japan, China, and Brazil For these areas the old regions supplied nearly all the machinery, much of the capital to start, and much of the skilled management in the first few years This migration was favored by many conditions The new mills in or near cotton-producing areas had advantages in using local raw cotton and in marketing the product locally These areas have dense populations and, even though the buying power of the individual is low, the total market is huge because of the millions of people and because coarse cotton goods are the cheapest clothing. Before the World War India, China, and Brazil were large markets for coarse cotton fabrics from Europe and the United States. Now Brazil and India supply nearly all their own requirements for coarse goods and Japan supplies China. These areas have abundant cheap labor, low living costs, and abundant cheap water power. In many districts the governments assisted the factories in starting and expanding by assessing low taxes, granting bounties, and providing protection by high tariffs. During the present

century the cotton textile industry has become more automatic with the marked improvement in machines. Consequently the cheap, less skilled labor of the new areas has been able to make quite well the coarse grades and undersell the factories of the older regions in Europe and the United States. Thus the older regions have been forced to make higher-grade fabrics and specialties. Further expansion in new regions is likely to take place.

## EXERCISES

1. (*a*) List the non-cotton growing areas that manufacture three-fifths of the world's cotton. (*b*) Where do these areas obtain their raw cotton?

2. (*a*) List the factors that favored the early development of the textile industry in western England. (*b*) List the conditions that favor the Lancashire cotton textile industry today.

3. (*a*) Why do the mills on the mainland of Europe with less spindles than those of United Kingdom use more raw cotton? (*b*) List the conditions that explain the concentration of the industry in the central part of the manufacturing region of the mainland. (*c*) Why is cotton manufacturing carried on by most European countries? (*d*) Why has Russia an important industry? Italy?

4. (*a*) What percentage of the world's spindles do Japan, India, China, and Brazil have? (*b*) What percentage of the world's cotton do they use in manufacturing? (*c*) List the conditions that explain the migration of cotton manufacturing to warmer regions during the present century. (*d*) What several conditions would cause this migration to continue?

## READINGS [2]

"Cotton Mills in Other Lands" — **4,** Chapter V, **59,** selected portions

"The Cotton Industry in England" — **89,** Part V, pp 80–81, 107–110, **A,** IV (1928), 187–195, **23,** pp 521–523; **12,** pp 284–286

"Cotton Manufacturing in Europe" — **23,** pp. 519–524; **59,** Chapter V

"Cotton Textile Industry of France" — **60,** pp 175–180; **100,** IV (October 29, 1928), 296–298

"The Textile Industry in China" — **A,** V (1929), 6–12; **59,** pp 21–26

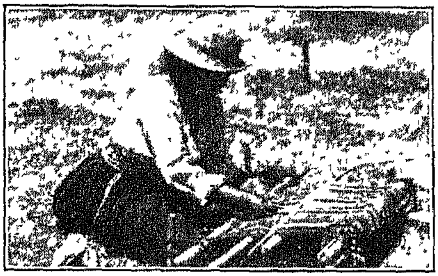
"Growth of Industry in India" — **59,** pp 26–31

"The Recent Growth of Cotton Manufacturing in Japan" — **27,** pp 78–85, **59,** Chapter II

## § III — THE WOOLEN MANUFACTURING INDUSTRY

In early times the manufacture of woolen goods was widespread, being found in every region where sheep and other wool-bearing animals grazed. It was older and more widespread than the manufacture by hand of cotton. It played a very important part in the industrial revolution, as it supplied many skilled workers and as it was already important in those areas where the industrial revolution came about. Whereas the manufacture of cotton entirely by hand has largely ceased, the primitive method of woolen manufacture is still carried on in many regions. Also in contrast to the cotton industry, woolen manufacture has not migrated to the wool-producing areas. The dots

[2] Numbers and letters refer to Selected References on pages 420–424



BOLIVIAN INDIAN WEAVING ON HAND LOOM

FIG 316 This woman weaves the woolen clothes for the family as she tends the sheep and alpacas on the high mountain pastures As the animals move away from her, she pulls up the stakes, rolls up the loom, and follows them

and crosses in Fig. 317 in the Mediterranean lands, except northern Italy and one area in Spain, in the nomadic herding region of Asia from the Mediterranean Sea to central China, and in the sheep-llama-alpaca grazing lands of the Andes, represent the manufacture by hand of woolen clothing, mats, rugs, blankets, shawls, and even tents (Fig. 316). All these areas, however, use a very small part of the wool of the world

Almost no wool is manufactured in areas between the tropics Sheep in these areas, unless in high mountains or plateaus, do not grow good wool and the people do not need warm woolen clothing

**The Lack of Modern Woolen Manufacturing in Some of the Chief Wool-Producing Areas** Four of the great sheep regions of the world (1, 3, 4, 5, map p 76) produce large quantities of wool Three of these regions supply more than four-fifths of the wool exports of the world In these areas the cool stimulating climates favor factory development and cause a demand for warm woolen clothing Many of the people have come from western Europe Yet these areas consume in factories not more than 5 per cent of the world's wool (Fig 317) Why? In the first place, these newly settled areas have only a few people per square mile (pp 4–5) This gives only a small supply of labor and the cost of labor is high They are distant from the regions that would supply the textile machinery The small population affords only a small market Because of a shorter and milder winter most of the people of Argentina, Uruguay, South Africa, Australia, and New Zea-

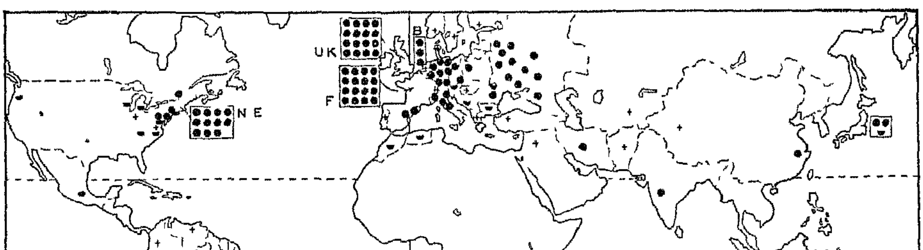



FIG 317 Though many regions make woolen fabrics by hand most of the wool of the world today is used in factories Almost none is used in the tropics, and very little in the great wool-producing regions of the southern hemisphere, western United States, and central Asia

land need less warm clothing than those of northern United States, Canada, and western and northern Europe Also the high value of cleaned and washed wool at the mill causes the cost of transportation to be only a small percentage of the total cost, thus wool can stand the cost of transportation so that the place of production has little influence on the areas of manufacture[3] Australia exports nearly nine-tenths of the wool it produces and in turn buys several million dollars worth of woolen goods from Europe and the United States

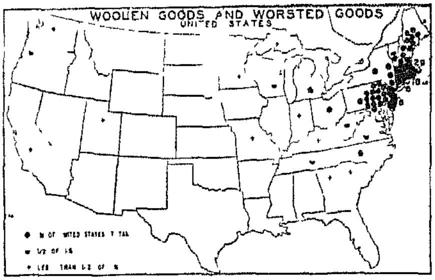
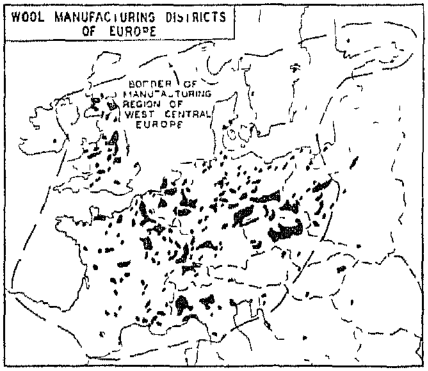



FIG 319 Woolen goods are made of carded yarns, worsted goods are made of combed yarns from which the short fibers have been removed and the long fibers left in parallel condition While the industry has a wide distribution, New England makes two-thirds of the total

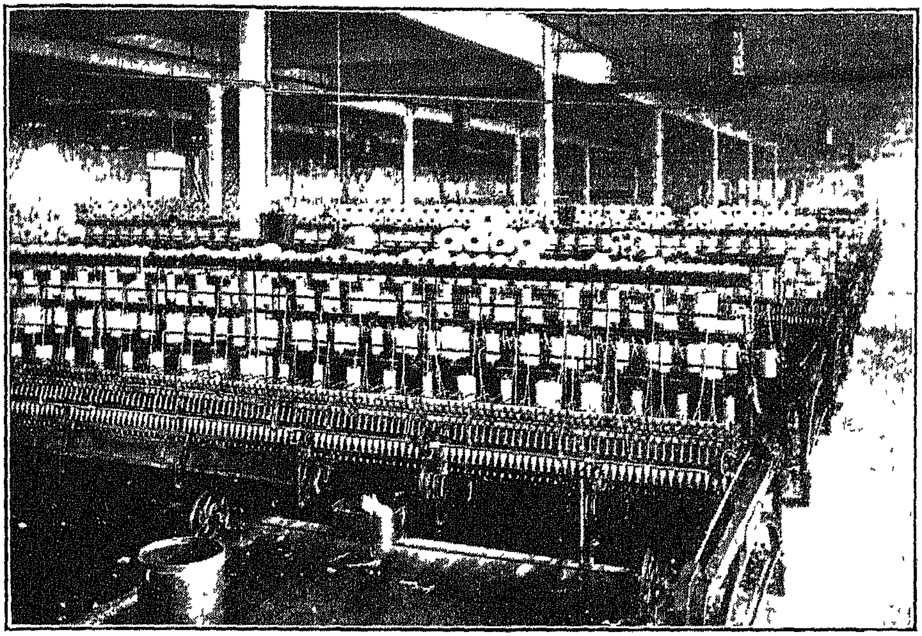



After Jonasson

FIG 318

**The Manufacture of Wool in Europe.** European factories consume nearly two-thirds of the wool of the world (p. 393). Woolen manufacture is concentrated in a broad belt from the United Kingdom to western Russia (Fig 318). In this belt many districts first developed the industry on a large scale. Most of the countries produce considerable quantities of wool (p. 91) As several grades of wool are mixed in fabrics, these districts import wool from many distant regions. The cool damp climate makes woolen clothing the most desirable and favors work in factories. The dense population provides a huge market and a large supply of cheap skilled labor. Even greater skill is required in woolen manufacture than in cotton mills. The chief districts lie in England east of the Pennines, in Belgium, France, and western and eastern Germany. Though not a factor in the establishment of the industry in early days, the use of coal, water power, and iron has been very significant in bringing these districts forward as the most important regions of woolen manufacture today Compare the coal and iron maps (p. 284 and p. 350) with that of the woolen districts (p. 394). All of these districts have excellent water and rail transportation, easy access to the

[3] This is more significant in the case of wool than that of cotton Raw wool is as expensive as raw ginned cotton. A pound of wool ready for spinning may cost three times as much as a pound of cotton at the mill A pound of ginned cotton is largely cotton fiber, whereas raw wool as it comes from the sheep and is shipped has grease, dirt, burrs, and seeds of plants which amount to from one-half to three-fourths of the total weight The processes of preparing the wool are rather expensive, they include washing to remove the dirt, scouring to remove the grease, and combing and carding to remove burrs and seeds and to straighten the fibers for spinning Also wool can be stored for a long time and transported long distances without deterioration.



*Courtesy of Lawrence Chamber of Commerce*

SPINNING ROOM OF WORSTED MILL, LAWRENCE, MASSACHUSETTS

FIG. 320 Note the huge size of the machines, and the pipes and apparatus overhead for keeping the humidity of the air high and uniform by spraying steam into the room.

sea, and world-wide connections for the importing of raw wool and the marketing of woolen goods.

**Wool Manufacture in the United States.** In the United States the woolen manufacturing industry is the most widely scattered of all the textile industries. Today nearly every state has woolen mills but the output in many of them is small. The large, modern, woolen factory is chiefly a development of the last seventy years. Before that time the manufacture of wool was carried on by hand and in small mills in nearly all regions where the people had settled, except the extreme southern states. In early days sheep raising was also important in eastern United States, even in New England. The local supplies of wool, the cool damp climate of the northern states, water power, skilled labor, and a home market favored the development of the woolen industry in many sections.

Although many states have woolen mills, most of the wool is consumed in large factories in a belt stretching from Maryland, through Pennsylvania, New Jersey, New York, southern New England into Maine (Fig 319). Almost no wool is manufactured in the great wool-producing areas of the United States (p. 96) The wool-producing areas of the Rocky Mountains are like the wool-producing regions of the Southern Hemisphere. They are new, sparsely settled, in them labor is expensive, and they have few areas from which goods could be shipped cheaply to large market centers. On the other

hand the northeastern districts are similar to those in west central Europe They had an early start, they developed the wool textile machinery, and they enjoy a stimulating climate They use water power, electric power, and coal brought from the northern Appalachian fields They have the most skilled labor of the country (Fig 320) They can import easily from any region of the world This is important because a great variety of wool is required and we import about two-fifths of what we use These districts have a huge market because of the dense population and the cool damp climate Also they have developed a great variety of products — woolen goods, worsted goods, carpets, rugs, hats, felts, plushes, shoddy, specialties, mixed cotton-woolen and silk-woolen fabrics

## EXERCISES

1 (*a*) Why was the manufacture of woolen goods widespread? (*b*) What regions today manufacture woolen fabrics by hand? (*c*) Why is almost no wool manufactured in the tropics?

2 (*a*) Explain fully the lack of wool manufacturing in wool-producing regions of the Southern Hemisphere (*b*) Why does a pound of wool ready for spinning cost three times as much as a pound of cotton at the mill?

3 List the factors (use the maps referred to in this section) that explain why the United Kingdom, France, Germany, and Belgium use in their mills nearly one-half of the wool consumed in mills

4 (*a*) Explain the concentration of woolen manufacturing in northeastern United States (*b*) Why is there little woolen manufacturing in the sheep-producing regions?

## READINGS [1]

"Making Cloth from Wool" — 4, Chapter XXXII, **11,** pp 48–56, **10,** Chapter XIII

"The Woolen Manufacturing Industry" — **23,** pp 530–538.

"The Woolen Industry in England" — **89,** Part V, pp 81–82, 115–117

"Historical Development of the Woolen Industry" — **77,** pp 365–404, **23,** pp 531–535

## § IV — THE SILK AND CLOTHING INDUSTRIES

### THE SILK INDUSTRY

**Regions of Raw Silk Production.** Review the conditions which make it possible for eastern Asia to produce nearly nine-tenths of the world's raw silk (pp 158–160) For a long time this was the only region that produced raw silk, but in the ninth century travelers carried silkworm eggs in bamboo staffs from China to the Mediterranean region Soon the growth of silkworms became common in Greece, Italy, and Spain In the sixteenth century it was introduced into southern France and since that time many countries have attempted to establish the raw silk industry, but without much success In southern Europe an early start, dense population and cheap labor, rough land suitable for the crops, and a warm climate for the mulberry tree favor the production of raw silk. Northern Italy, with its dense population and more

[1] Numbers and letters refer to Selected References on pages 420–424

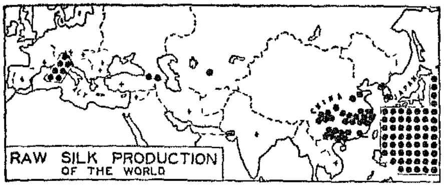
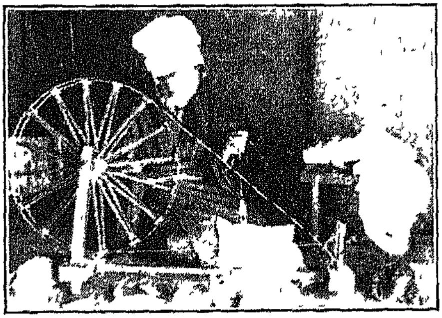



FIG 321 Each dot represents one per cent of the world s production, each cross less than one-half of one per cent Three countries produce nearly all the world s raw silk Why is Japan able to produce 57 per cent of the world s total?

rainfall, produces most of Europe's output (Fig 321).

**Regions of Silk Manufacture.** For a long time silk fabrics have been more largely used in China and Japan than in any other region (Fig 322) Hand-made silk fabrics are used in great quantities, but the manufacture of silk by modern machines has not expanded greatly there owing to the low buying power of the people and tariffs against these goods in the Western Hemisphere. Japan and China have only 22 per cent of the machine manufacture of the silk of the world in spite of the production of most of the world's raw silk and the use of enormous quantities of silk fabrics. The price of raw silk per pound is so great (from $2.00 to $8 00) that the transportation cost is a small factor in sending raw silk half around the world to desirable places for its manufacture

Europe has nearly one-fourth of the world's modern silk manufacturing industry. During the nineteenth century France led the world The industry started in Lyon, in the region of raw silk production France has one-tenth of the world total and nearly half that of Europe Many small Swiss and northern Italian towns have silk mills Silk manufacturing is carried on in the southern, eastern, and western parts of Germany and in the cotton and woolen districts of the United Kingdom In all these districts some or all of the following conditions have been significant in the development of the industry highly skilled and relatively cheap woman



*Courtesy of Japan Tourist Bureau*

WINDING SILK ON BAMBOO PIPES FOR USE ON WEAVING LOOMS

FIG 322 Review the steps in the production and preparation of raw silk Note the location of the modern textile mill, page 143 Much of the clothing of the people of the Far East is still made by hand methods

labor, cheap water and coal power, the production of some raw silk, large market, adaptation to rapidly changing fashions, and the great development of other industries

An interesting situation to all of us is the fact that the United States, which does not produce a pound of raw silk, has more than one-half of the complex manufacturing of silk of the world (Fig 323). Raw silk, one of our chief imports in value, comes chiefly from Japan and China Raw silk is worth thirty or forty times the value of raw cotton, being so valuable that much of it moves from the Pacific ports across the United States in fast, guarded trains that get the right-of-way over fast passenger trains This high value of the raw material renders the cost of

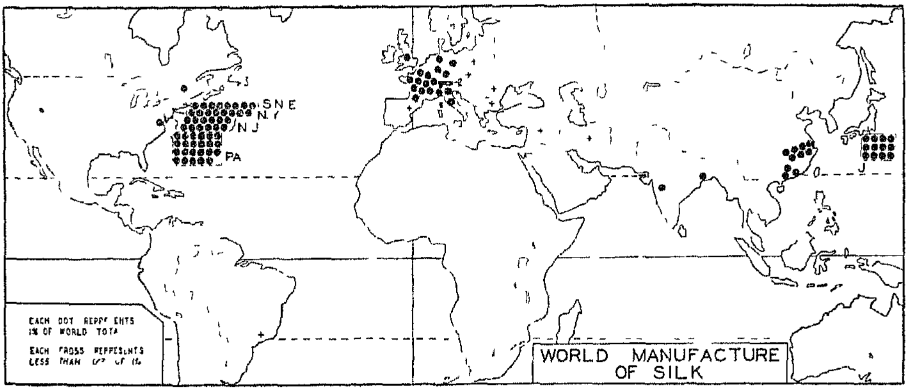



FIG 323

transportation a small fraction of the cost of the finished goods The great development of our industry has resulted from a protective tariff on silk manufactures, high purchasing power of the masses of our population, quantity production with modern machines and devices for making standard articles for a large consuming population with a high standard of living, and skilled workers.

Though carried on in many districts of the country, the manufacture of silk is concentrated in Pennsylvania, southern New York, and northern New Jersey. These areas produce 43 per cent of the world's total and seven-eighths of our output The city of Paterson, New Jersey, manufactures nearly one-sixth of our total Several conditions have favored this concentration. The industry started early and because of the skilled textile workers and a knowledge of the industry, new companies entering the business established plants there As silk manufacturing is fairly light work, the percentage of women laborers in silk mills is higher than in any other textile industry — the silk mills employ the wives and daughters of workers in the heavier manufacturing industries. As the cost of power in silk manufacturing is low, sufficient power is available at low cost Of great importance is the location in and near the great centers for making silk garments for people able to buy expensive goods

**Production of Artificial Silk.** Though only half a century old, rayon in the amount used in the modern textile industry has surpassed natural silks, being about three times that of natural silk. Though it does not compete directly with natural silk, its high luster and low price have placed it in great demand by the masses of people Its great uses are in knit goods and in mixed fabrics of wool, cotton, and natural silk. The production of the fiber, the manufacture of rayon fabrics, and the use of the materials take place in the great manufacturing regions of the world. Rayon manufacture has developed especially in or near the great textile districts of western Europe and eastern United States (Fig. 324).

## THE CLOTHING INDUSTRIES IN THE UNITED STATES

The making of wearing apparel is one of our leading industries. The value of the products made, not including the spinning, weaving, and

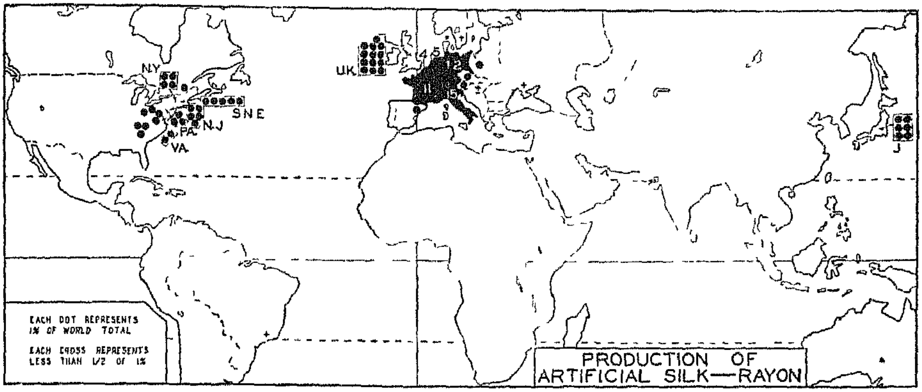



FIG 324 West central Europe and east central North America produce and manufacture more than nine-tenths of the world's artificial silk They have skill in textile industries, as well as the machinery, the power, and the great markets.

finishing of textiles, almost equals that of motor vehicles The manufacture of wearing apparel in the United States shows even a greater concentration in the northeast than the making of cotton or woolen fabrics. The southern states which use so much of our cotton make very little clothing. The production of wearing apparel is chiefly a city industry in regions of dense population (Fig. 325). The cities may easily obtain a variety of materials as is strikingly illustrated in Fig 326. It shows that these establishments which obtain much of their materials from

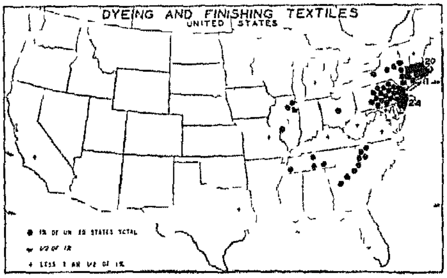



FIG. 326 This map represents establishments that bleach, dye, and finish cotton, woolen, and silk fabrics obtained from textile mills Southern New England, New Jersey, Pennsylvania, and New York together carry on four-fifths of the dyeing and finishing of textiles Many textile mills bleach, dye, and finish their own product, such mills are not represented on this map

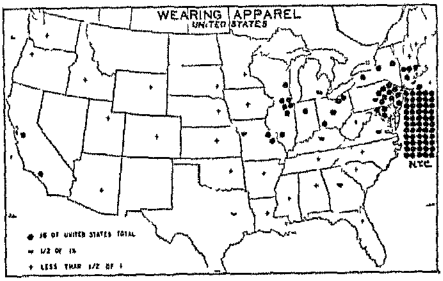



FIG. 325. Wearing apparel as represented in this map includes the manufacture of men's and women's clothing, men's work clothes, shirts, furnishings, and handkerchiefs New York State, with the concentration chiefly in New York City, has 59 per cent of the total The northeastern states manufacture nine-tenths of our clothing

southern and northern cotton, woolen, and silk mills, dye, finish, and market them for clothing manufactures in nearby centers The large cities possess the labor which is a big factor in the industry The cities of the northeastern part of the country have hundreds of thousands of immigrants accustomed to low wages. The clothing factory, where one person performs a single small piece of work on a garment, offers work in which these people soon become skilled Also, the successful selling of ready-made wearing apparel requires a huge

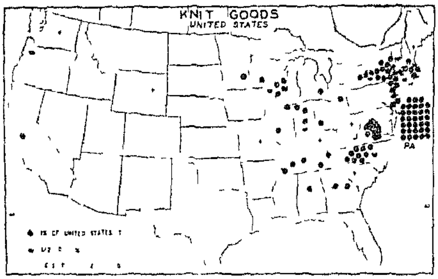



FIG 327 This map represents those establishments whose products are made by knitting machines from cotton wool silk, and other textiles They include especially hosiery underwear and knitted outer garments Pennsylvania New York and New Jersey make more than half the total for the entire country

market with vast numbers of persons so that many of each of the sizes and styles of clothing may be called for New York City, with its millions of people, large immigrant population, midway location between the textile mills of the southern states and New England, and great distribution facilities, is the leading clothing manufacturing center However, many other large cities are important centers These same factors are illustrated on the map of knit goods (Fig 327), a highly specialized phase of textile manufacturing

## EXERCISES

1 (*a*) List again the factors that favor the great production of raw silk in eastern Asia (*b*) What conditions favor sericulture in southern Europe? (*c*) Why is the rainfall of this region less favorable for the mulberry tree than that of Japan?

2 (*a*) Explain why Europe manufactures one-fourth of the world's raw silk (*b*) Explain the distribution of mills in western Europe

3 (*a*) List the factors that explain why the United States has more than half the complex manufacturing of silk in the world (*b*) Why has the industry concentrated in Pennsylvania, southern New York, and northern New Jersey?

4 Account for the location of artificial silk production, manufacture, and use.

5 Explain the distribution in this country of the dyeing and finishing of textiles, of the manufacture of wearing apparel, and of the manufacture of knit goods

## READINGS[5]

"Silk Manufacture" — 4, pp 270–281, 27, pp. 70–76, 23, pp 539–547, 2, V, Chapter XIX; 10, Chapters XVI and XVII.

"Silk and the Silk Industry" — 44; 56; P, LX (February, 1934), 24 ff

"Silk Manufacture in Europe" — 2, IV, pp 374–386

"Silk Manufacturing in America" — 77, pp. 413–425

"Rayon" — 77, pp. 362–364, 425–426; B, XXXII (1933), 45–55.

"The Manufacture of Clothing" — 23, pp. 556–559; 11, pp. 58–63; 10, Chapter XLIV

"Rayon—Japan"—A, XI (1935), 105ff.

## TOPICS FOR INVESTIGATION AND REPORT

"Attempts to Produce Silk in the United States" — 77, pp 408–412.

"Attempts to Produce Natural Silk in America" — B, XXVIII (1929), 279–285.

"Silk Industry of Scranton, Pennsylvania" — A, V (1929), 81–85

"Silk Reeling in Japan" — J, XX (1930), 240–244

"The Rayon Industry in the United States" — B, XXXII (1933), 45–55.

"The Production of Rayon Fiber" — 4, Chapter XXX, 77, pp. 362–364

[5] Numbers and letters refer to Selected References on pages 420–424.

## CHAPTER XXXVII

# THE GREAT MANUFACTURING REGIONS AND TRADE

## § I — COMMERCIAL REGIONS AND THEIR COMMODITIES

**The Relation of Manufacturing Regions to the Great Commercial Regions.** We have learned in previous lessons that many commodities move into the great manufacturing regions of east central North America and west central Europe These two regions that produce the bulk of the world's modern manufactured articles require enormous quantities of many raw industrial materials not locally produced at all or only in small amounts, for instance rubber, cotton, jute, Manila hemp, silk, wool, tin, copper, manganese, vanadium, lead, zinc, nickel, bauxite, petroleum, iron ore, tannin extract, hides, furs, lumber, etc With their excellent bases for manufacturing, these two regions are in a position to buy for their numerous factories all these raw materials and many partially manufactured articles Although they produce many foodstuffs in large quantities, they require foodstuffs in addition to feed the millions of industrial laborers and the workers engaged in trading and in all the professions They are the chief importers of wheat, flour, corn, rice, meats, bananas, sugar, dairy products, coffee, tea, cacao, and spices.

These two regions have the great commercial trade organizations and the large merchant marines of the world (Fig 328) They have most of the colonies of the world They have two of the chief railway nets and the principal inland waterways (Fig. 329) They have the chief accumulations of capital for investment in industry, in trade, and in foreign countries Consequently they are in a position to distribute an enormous variety and quantity of manufactured wares to their colonies and foreign countries in all parts of the world In fact the factories can be maintained only by wide distribution of wares This industrial and commercial relationship represents an economic organization for the manufacturing regions and also for the producers of raw materials, foodstuffs, and partially manufactured wares. An example will serve to make clear this economical exchange of products

Argentina, the leading commercial nation of the Southern Hemisphere, has only a little coal, petroleum, and other minerals It has no iron ore and almost none of the chief alloy minerals and little developed water power While it has a stimulating climate and a high type of people, it has not developed much manufacturing. Its manufacturing consists chiefly of the primary preparation of its farm and forest products for export and the making of rather simple

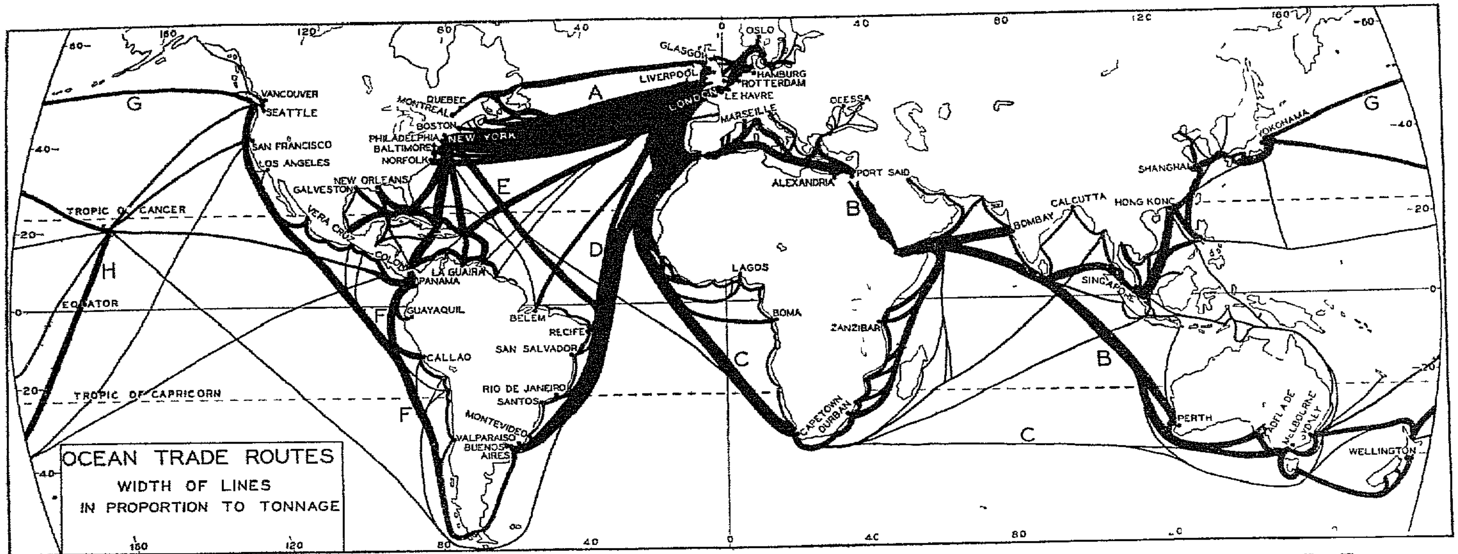



FIG. 328. Ocean trade routes A North Atlantic, B Mediterranean-Asiatic-Australian, C Cape of Good Hope D European-eastern South American, E Eastern North American-eastern South American, F North American-western South American, G North Pacific; H. North American-Australasian

The width of the lines emphasizes the great importance of Europe and North America in world trade The map shows that most lines seem to connect with these two areas Which are the chief ocean trade routes? How are they related to the chief railway nets? Why are the Panama and Suez Canals so important? The North Atlantic trade route is the most important ocean trade route Over it in each direction moves an enormous variety and quantity of freight and a large number of passengers in the most modern and largest steamships It connects the two chief coal and iron producing areas and the two great manufacturing regions of the world The ocean routes next in importance are B, C, and D Over these routes to northwestern Europe move many temperate and tropical foodstuffs and raw industrial materials. What products move over the South American routes to the United States?

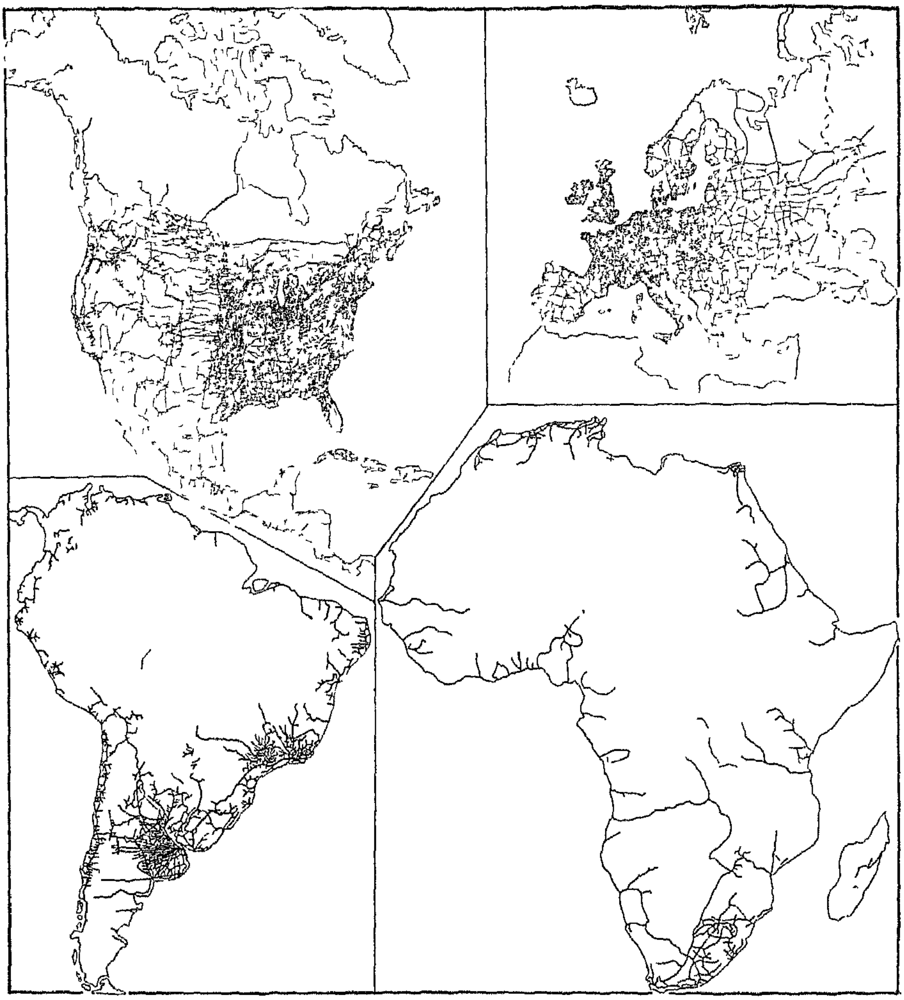
wares for domestic consumption,[1] most of these industries are favored by high protective tariffs. All these plants make goods valued at a little more than one billion dollars, a value less than one-tenth that of the manufactured articles of the United Kingdom. Also, Argentina in an area twelve times that of the United Kingdom, has only one-fourth as many people, the population density averages only ten per square mile, whereas in the United Kingdom it is nearly five hundred Also, Argentina has broad areas of fertile pasture and crop lands and its small population allows the exportation of the bulk of these products. On the other hand the United Kingdom produces only a fraction of the foodstuffs and raw materials it needs Consequently, with an early start in industry, a dense population, coal, iron, and other bases for factory development, it has a great surplus of wares. Most of its exports are manufactured or semi-manufactured products In contrast, Argentina imports three-fourths of the manufactured articles consumed by its population, while more than nine-tenths of its exports consist of foodstuffs, raw industrial materials, and partially prepared products. Thus the stage of industrial development is perhaps the chief basis for international trade today.

**The Commercial Regions of the World.** Figures 330 and 276 show the relation of the chief manufacturing regions of the world and the regions that carry on a large portion of the international trade

**West Central Europe.** In percentage of international trade west central Europe ranks above all others. The manufacturing region of Europe handles one-half of the foreign trade of the world Seven countries — United Kingdom, Germany, France, Belgium, Holland, Denmark, and Switzerland — have two-fifths of the total of the world This concentration is somewhat misleading because this region is divided into small countries If they were combined into one unit, their foreign trade would be reduced by one-fourth They are much alike in climate and people and several of them have large colonial empires with which they trade. All of them have made intensive use of their lands and resources. Their production per man is fairly high, which means that their use of modern machines, methods, and transportation is great. Consequently they depend to a great extent upon foreign trade. Belgium and Denmark export half of what they produce, Switzerland one-third, United Kingdom and France about one-fourth, and Germany about one-fifth In Holland dairy products and vegetables, and in Denmark and Ireland dairy products and meats rank high in the exports. In all others manufactured wares are the chief exports

**The United States.** The second region in international trade is the United States with 13 per cent Because of the large size and variety of resources, the domestic trade of the United States is especially great compared to the above countries of

[1] The chief manufacturing industries of Argentina include meat packing, flour milling, cigars and cigarettes, wines, sugar, cotton and woolen textiles, beer, dairy products, boots and shoes, refining petroleum, and *quebracho* extract. Of the products of these plants only meats, flour, extract, and dairy products are exported in considerable quantities



THE RAILWAYS OF THE CONTINENTS

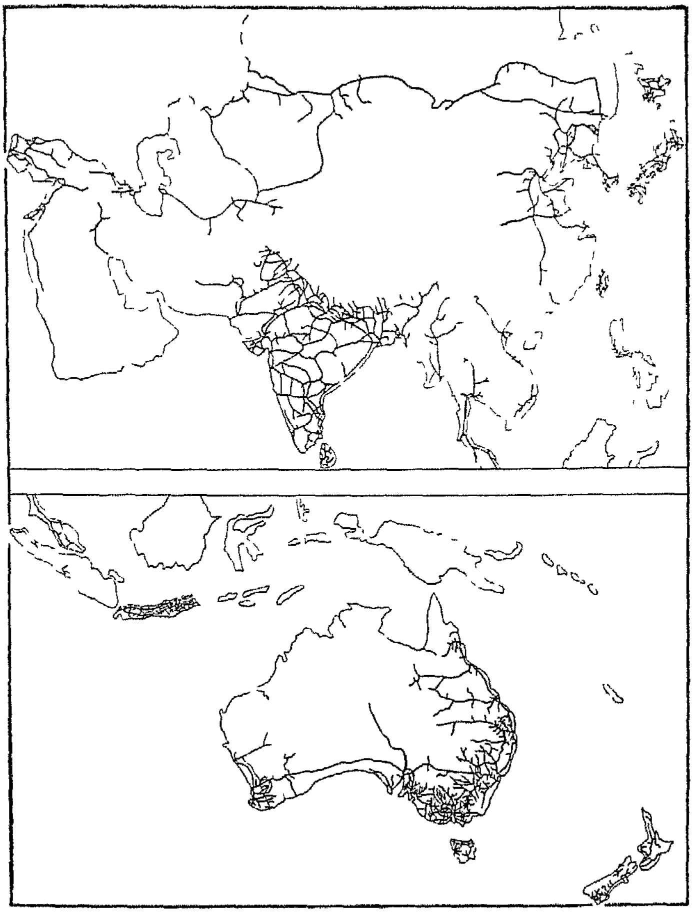
FIG 329 The six railway maps are on the same scale

A close network of railways covers east central North America, western Europe, India, Japan, southeastern Australia, southern Africa, eastern Brazil, eastern Argentina, and north and central Chile In general these regions are rolling plains or low mountains They have stimulating climates They have active peoples, with many large cities They are regions of great agricultural production and great manufacturing development, they produce a large volume of goods per square mile, and have contact with the chief ocean highways

From the maps you have studied list the factors that account for the absence of railway lines in northern North America In eastern United States note the relation between mountain areas and the small number of railway lines, note and explain why so many of the railway lines in the Great Plains end before reaching the Rocky Mountains In western United States and Mexico account for the irregular pattern of railways

In South America explain the railway network of eastern Brazil, eastern Argentina, northern and middle Chile In the northern part of western South America explain why most of the railways are short and why many of them do not connect with the sea Explain the absence of railways in the central portion of northern South America

In northern Europe compare the relation of relief temperature, and forests and the small number of railways In southern Europe explain the small number of railway lines in the area between the Black and Adriatic seas



In general, the small number of railways in Africa as a whole may be explained by the recency of economic penetration and development by Europeans Using the physical maps, explain the absence of railways in all the central part of northern Africa, in the Congo Basin, in Abyssinia From the maps, text, and tables you have studied list the products which the railways of northern Africa bring to the coast for export Do the same for the Guinea coast and south Africa What desert area in south Africa has very few railway lines? Why does a similar desert area on the west coast of South America have a much larger number of railway lines?

Using the physical maps and the materials you have studied, explain the absence of railway lines in northern Asia, in central Asia; in western China, in western Asia Explain the density of the railway network in Japan, in India, what products do the railways east of the Caspian Sea bring into European Russia? In four areas of Asia European enterprises have been chiefly responsible for the development of railway systems, in Asiatic Russia (Turkestan and Siberia), in British India, in Malaya, and in the Dutch East Indies What parts of Asia have railways because of American interests?

Explain fully the absence of railways in central and western Australia, in northern Australia Note on the map of eastern Argentina that many railways join the seaboard In contrast note and explain why in southeastern Australia so few railways join the seaboard Explain the absence of railways in Borneo, Celebes, and New Guinea In the southern part of New Zealand why are most of the railways on the southeastern side?

*The railways in the South American map are after Jones,* South America, *Henry Holt & Company, those in the European map after Van Valkenburg and Huntington,* Europe, *John Wiley & Sons, those in the African map after Beaver and Stamp,* Africa, *Longmans, Green & Company, those in the Asia map after Stamp,* Asia, *Methuen & Company, and* Goode's School Atlas; *those in the Australasian map after Taylor,* Australia, *Rand McNally & Company, and* Goode's School Atlas, *those in the North American map after* Railway Map, United States, *Chief of Engineers, U S Army,* Atlas of Canada, Trade Promotion Series, No. 16, *U S Department of Commerce, and* Goode's School Atlas

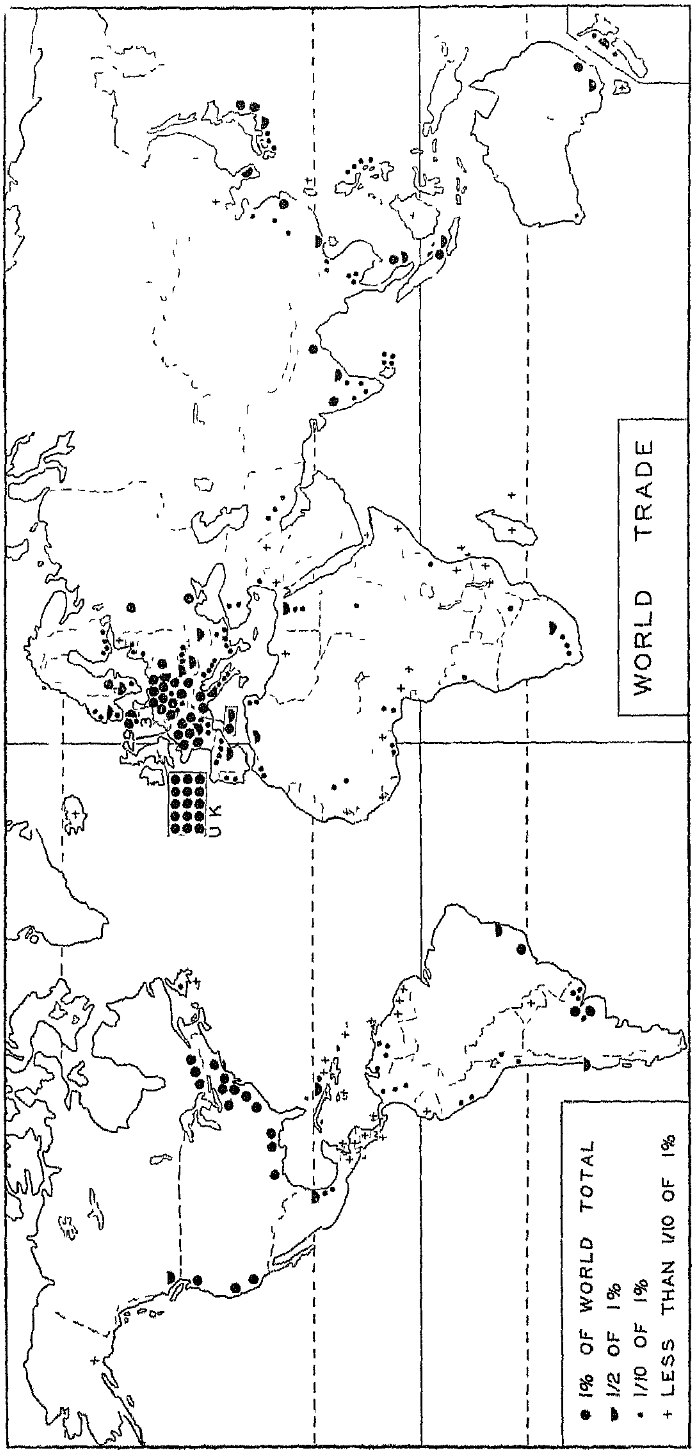
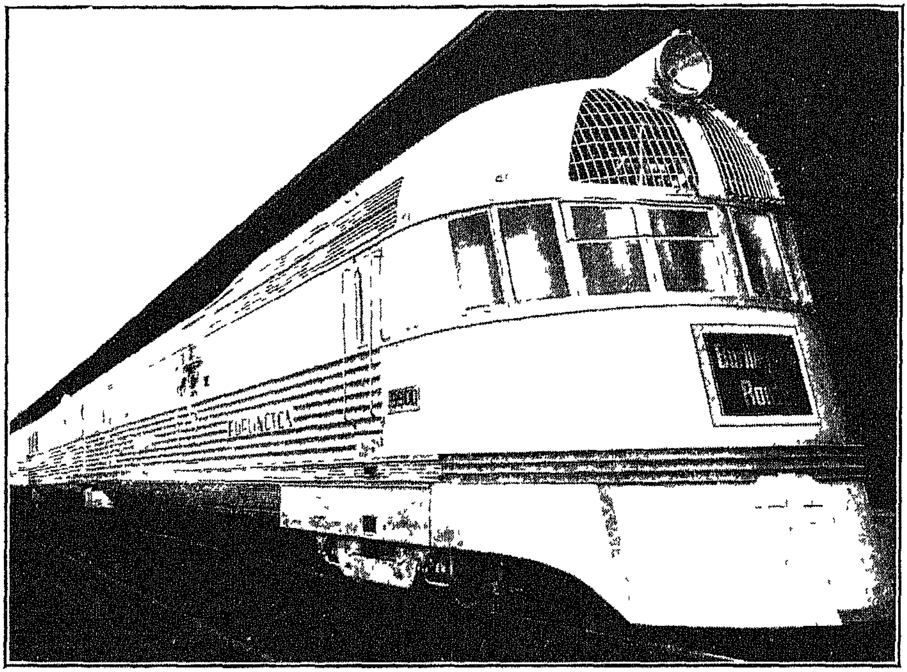



FIG. 330 The leading three regions in world trade are west central Europe east central North America and southeastern Asia The sparsely populated temperate regions of the Southern Hemisphere rank next, they have a very high per capita trade.

Europe. If the United States were cut up into small countries like those of Europe, the foreign trade of each, on a percentage basis, would be more than twice as much as that of the United States at present. This country has large agricultural areas like those of Argentina, producing foodstuffs and raw industrial materials for the eastern manufacturing regions of this country and Europe. Also it has mineral and forest areas contributing to the eastern mills and providing a market. The great size of the United States tends to reduce the importance of foreign trade. Smaller countries tend to have relatively a greater foreign trade. For example the United Kingdom, with only one-third as many people as the United States and 3.2 per cent of the area, has a per capita foreign trade of $150 per year, while that of the United States is about $40. However, in spite of great size and large domestic commerce, the total foreign trade ranks almost as high as that of the United Kingdom. Our population with a high standard of living, extensive fertile farm lands, and great development of factories and transportation are basic to our commercial activity in international trade.

**Southeastern Asia.** The third region in international trade is southeastern Asia, with 12 per cent of the world total. India, Japan, and China lead, but the Netherlands East Indies and Malaya rank close to these three countries. India and China have carried on foreign trade in small amounts for hundreds of years but Japan was not opened to world trade until 1854 by Perry's Treaty. The high density of population in China, the low standard of living, and poor transportation facilities make it impossible for the Chinese to be very active in foreign trade. We have learned (p. 143) that most of the Chinese on their small farms produce only the bare necessities of life and that in the case of drought or flood they are unable to transport even a small surplus to their neighbors at home. Foreign investments, modern machines, and modern methods have been slow in entering China. Within an area larger than that of the United States and with four times as many people, China trades to the extent of less than $2 per person per year. India, two-fifths as large as China and with three-fourths as many people, has a per capita trade of $3.50 per year. Foreign investments, political connections with the United Kingdom, and plantation production of tropical products account for the higher per capita trade of India. Japan, with one-seventh the area and one-fourth as many people as India has a total foreign trade as great as that of India and a per capita trade of nearly $25 per year. Although only 15 per cent of its area is arable, Japan exports two agricultural commodities in large quantities — silk and tea. It exports a variety of manufactured articles to many regions. It imports rice, wheat, other foodstuffs, cotton, jute, coal, iron, and other minerals. This is another illustration of the influence of small area, modern industrial activity, shipping facilities, and commercial contacts on foreign trade (Fig. 332).

**Temperate Regions of the Southern Hemisphere.** As a group the temperate regions of the Southern Hemisphere rank fairly high in foreign trade. Together they have 6 per cent of the world total. Their per capita



*Courtesy of Chicago, Burlington, and Quincy Railroad*

THE LATEST IN RAILROAD TRANSPORTATION — THE BURLINGTON ZEPHYR

FIG 331 The whole train — framework, exterior sheathing, and inside trimmings — is made of stainless steel, consisting of 18 per cent chromium and 8 per cent nickel The three-car train weighs about one hundred tons, only slightly more than one car of conventional equipment Electric power transmitted to gears on the front truck is produced by an eight-cylinder oil-burning Diesel engine The train will average two miles to the gallon of fuel oil and the tank holds six hundred gallons of oil An ordinary train has to stop every two hundred miles for coal and water The Zephyr will make more than one hundred miles per hour Compare this most modern method of transportation with those shown in Figs 11, 44, 67, 114, 126, and 266

trade ranks very high — New Zealand $350, Australia $180, Union of South Africa $100, Argentina $90, and Uruguay $85 The per capita trade ranks high because of extensive areas of fertile grazing and farming lands, small population of progressive people, rich mineral deposits, excellent transportation facilities, and the lack of manufacturing.

Thus the temperate regions of the Southern Hemisphere have a large surplus for the manufacturing regions of the Northern Hemisphere — New Zealand: wool, butter, frozen meats, cheese, and hides; Australia wool, wheat, hides, butter, flour, gold, lead, beef, mutton, copper, and zinc, South Africa: gold, wool, diamonds, and hides, Argentina: wheat, corn, linseed, beef, wool, hides, mutton, and *quebracho*, Uruguay wool, beef, mutton, and hides. These countries buy most of the manufactured commodities they use from the manufacturing regions of the Northern Hemisphere

**Wet Tropical Regions.** In general, wet tropical areas have a small foreign trade. However some islands

and mainland districts have great total trade and high per capita trade because of the plantation production of tropical crops that cannot be grown in temperate regions, and because of their output of tin, petroleum, and other minerals and forest products These areas include the Netherlands East Indies, with sugar, rubber, tea, coffee, copra, tobacco, petroleum, tin, and spices, Malaya, with rubber, tin, petroleum, copra, rice, and spices, Ceylon, with rubber, tea, and spices, Philippine Islands, with Manila hemp, sugar, copra, coconut oil, and tobacco, Hawaiian Islands, with sugar and pineapples, tropical Africa, with cacao, forest products, and fibers, Brazil, with coffee, cacao, manganese, and forest products, northern South America, with coffee, cacao, bananas, petroleum, and bauxite, Central America, with coffee, bananas, sugar, and forest products, the West Indies, with sugar, tobacco, fruits, and spices These regions on ocean highways exchange their products for manufactured wares and temperate foodstuffs. Though these areas produce enormous quantities of some commodities, their total trade is kept down by the low standard of living and the low buying power of most of the people These people live with less clothing and other materials than people in the temperate regions. Though these tropical products move primarily into temperate regions, the impelling cause of the movement is the great need for them in factories and the fact that the people in temperate lands are able to buy them in large amounts

## EXERCISES

1 Take an outline map of the world and color the United States and its possessions red, color the British Empire blue, France and her colonies green; Holland and her colonies brown, and Belgium and her colonies yellow. The possession of colonies is a significant basis of trade. Show how the different regions of the British Empire favor the trade of the United Kingdom

2 On this same map draw a line representing the trade route between Argentina and the United Kingdom. On it write the names of products that move from Argentina to the United Kingdom and those that move from the United Kingdom to Argentina. What are the bases for this trade?

3 Answer the questions under Fig. 328 and Fig. 329. From the *Statesman's Yearbook* get the total tonnage passing through the Panama and Suez Canals Explain these figures in relation to the number of routes converging on the canals and the location of land masses in relation to the canals

4. (*a*) What are the important factors in determining the location of railway networks? (*b*) Why do central Asia, the Andes, the Sahara, central Australia, and northern Canada have few railways?

5. (*a*) List the bases for a great international trade of west central Europe. (*b*) What relation exists between a very dense population and per capita trade? Give examples (*c*) Why does southeastern Asia rank as the third region in international trade in spite of its very dense population with a small buying power per person?

6 (*a*) Why do the temperate regions of the Southern Hemisphere have a high per capita trade? (*b*) What relations do the railways have to this trade (pp. 404–405)?

7 From the text and maps complete the following table of exports.

| *Countries* | *Animal Products* | *Crops* | *Minerals* |
|---|---|---|---|
| Uruguay | Wool<br>Hides<br>Beef<br>Mutton | | |
| Argentina | | | |
| South Africa | | | |
| New Zealand | | | |
| Australia | | | |
| West Indies | | | |
| Malaya | | | |

(other regions may be added)

8 Why do the following areas have little trade: Tibet, northern Canada, Greenland, north central Africa, northern Australia, the Amazon region of South America? (In answering these questions, refer to the population, relief, rainfall, grazing, forest, and manufacturing maps in the text )

## FOUR EXTRA LESSONS

I and II — "Transportation and its Significance" in four parts

I
1. "Different Methods of Transportation" — 22, Chapter IV, 15, Chapter XIII
2. "The Railroads of the Continents" — 16, pp 89–99 or 15, Chapter XIV or A, IV (1928), 217–231

II
3. "The Use of Inland Waterways" — 16, pp 156–164
4. "The Ocean and its Carriers" — 23, pp 717–724, 16, pp. 137–144

III "The Commerce of Europe" — 61, Chapter IX

IV "The Trade Center and Its Business" — 23, pp 865–906

## READINGS[2]

"The Law of Trade" — 23, pp 709–716, 86, Chapter XLII, 19, pp 261–268.

"The Commerce of Europe" — 61, Chapter IX

"The Use of Ships" — 15, Chapter XV; 86, Chapter XLIII

"Ocean Trade Routes" — J, XVI (1926), 291–296.

"The Yangtze-kiang" — 68, pp. 93–104, also, "The St Lawrence River" — 68, pp 119–131

"Our Growing System of Inland Waterways" — A, VII (1931), 154–165

"Towards a New Era of Speed" — P, LXII (April, 1934), 9 ff.

"Trade Routes of North America" — 23, pp 725–748.

## TOPICS FOR INVESTIGATION AND REPORT

"Shipping Foodstuffs the World Over" — 13, Chapters I and II.

"What the Retailer Does with Foodstuffs" — 13, Chapter XXXII.

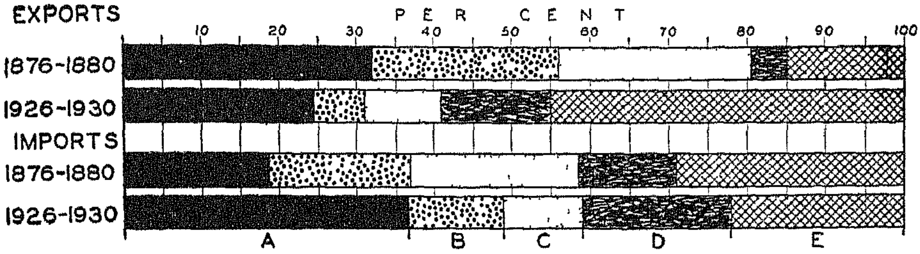
"The Evolution of Transportation in the United States" — 94, Chapter XI, 19, pp. 268–292.

"The Distribution of the Railways of the World" — 16, pp 89–99; 15, Chapter XIV.

"Methods of Transportation" — 21, IV (selected portions for different reports)

"Different Methods of Transportation" — "The Magic of Wings," "Dogs in Harness," "The Llama," "The Railways to Civilization," "Camels and Caravans," "From Galley to Steamer," "Whence the Wheel," "The Pullman Car," "Transportation through Pipes" — L, I.

[2] Numbers and letters refer to Selected References on pages 420–424



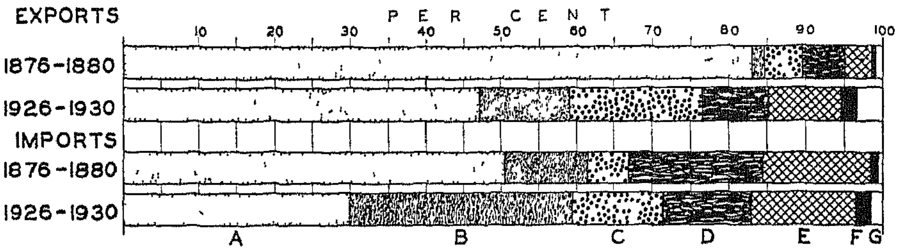

CHANGES IN OUR EXPORTS AND IMPORTS BY CLASSES

FIG 332 A Crude materials, B crude foodstuffs, C manufactured foodstuffs, D semimanufactures, E finished manufactures The lines represent the average of five years — 1876 to 1880 and 1926 to 1930

## § II — THE FOREIGN TRADE OF THE UNITED STATES

**The Location of the United States Favors Trade.** The United States has a frontage on both the Atlantic and Pacific Oceans giving us direct contact with Europe, Africa, and eastern and northern South America on the one hand, and with Hawaii, Asia, and western South America on the other These contacts are emphasized by the ocean traffic between the United States and these areas (map p 402). Even the East Indies and distant New Zealand come within the sphere of our commercial activity. As ocean freight rates are low it costs less in many cases to bring goods from New Zealand to New York than to take goods from Kansas City to New York by rail. The Panama Canal, completed by us in 1914, brought our east coast in close contact with western South America and Asia on the one hand and our west coast with Europe and Africa on the other. 3 The broad expanse between the Atlantic and Pacific coasts and between Canada and the Gulf of Mexico gives us a variety of regions and products which favor both internal and foreign trade. 14 Along our northern border lies a huge country, rich in resources and with only one-tenth as many people as we have. To the south lie the wet tropical lands of the West Indies, Central America, and northern South America. The middle latitude location of the United States gives the country favorable climatic conditions for health, comfort, energy, initiative, and consequently a great development of resources and a high standard of living The development of our resources has created a demand for foreign trade, it has caused a change in our exports and imports and in the regions with which we trade, as we shall now see.

**Changes in Our Trade.** During the past fifty years there has been a significant change in the character of our exports (Fig 332). Crude materials, like cotton, tobacco, lumber, coal, and petroleum, have decreased from 32 per cent of the total to 24 per cent. Crude foodstuffs, like wheat, meat, and fruits have decreased from 24 to 7 per cent, and manufactured foodstuffs, like flour and lard have decreased from 24 to 10 per cent. The actual movement of these classes of exports is far greater now than it was fifty years ago, but the percentage they make of the total is less now because of the greater relative impor-




OUR TRADE WITH THE DIFFERENT CONTINENTS

FIG 333 A Europe, B Asia, C Canada, D southern North America — Mexico, Central America and the West Indies, E South America, F Africa, G Australia and New Zealand What percentage of our exports does Europe take today? What percentage of our imports comes from Europe? What region ranks second as a market for our exports? Third? What region ranks second as a source of our imports? Third?

tance of semimanufactures and finished manufactures Semimanufactures, like steel sheets and plates, thread and fuel oil, have increased from about 5 per cent of the total to 14 per cent, and finished manufactures, like automobiles, agricultural machinery, mill machinery, and gasoline, from 15 per cent to 45 per cent. Thus we have changed from a country exporting primarily raw materials and foodstuffs to one exporting chiefly manufactured wares This has had a significant influence on the character of our imports.

In our imports the changes are the opposite. The percentage of crude materials has doubled (lower half of Fig. 332) Crude foodstuffs and manufactured foodstuffs together have decreased by one-half, roughly Finished manufactures have decreased by one-third, but semimanufactures have increased by one-third. In all classes the total movement is greater than it was fifty years ago. These changes are natural in a country that has developed greatly its manufacturing industries

The industrial development of the United States has caused a change in the markets for our exports and the source of our imports As late as fifty years ago four-fifths of our exports went to Europe and one-half of our imports came from Europe (Fig. 333) Then we had not developed our manufacturing industries as much as western Europe Consequently, we supplied their factories with raw materials and their workers with foodstuffs and bought manufactured wares from them Today Europe is our chief market and source of imports, but relatively it is much less important in our total trade. With the development of our industries we depend less on Europe for manufactured articles and we have turned to new sources of raw materials for our factories. These we buy especially from Canada, southeastern Asia, and the mining regions of the Southern Hemisphere

**The Principal Regions with Which We Trade.** The United States trades with nearly every country in the world But our trade with a few regions ranks well above that with all the others

**Trade with West Central Europe.** The most important branch of our trade is with western Europe (Fig. 334). Its bases are long established

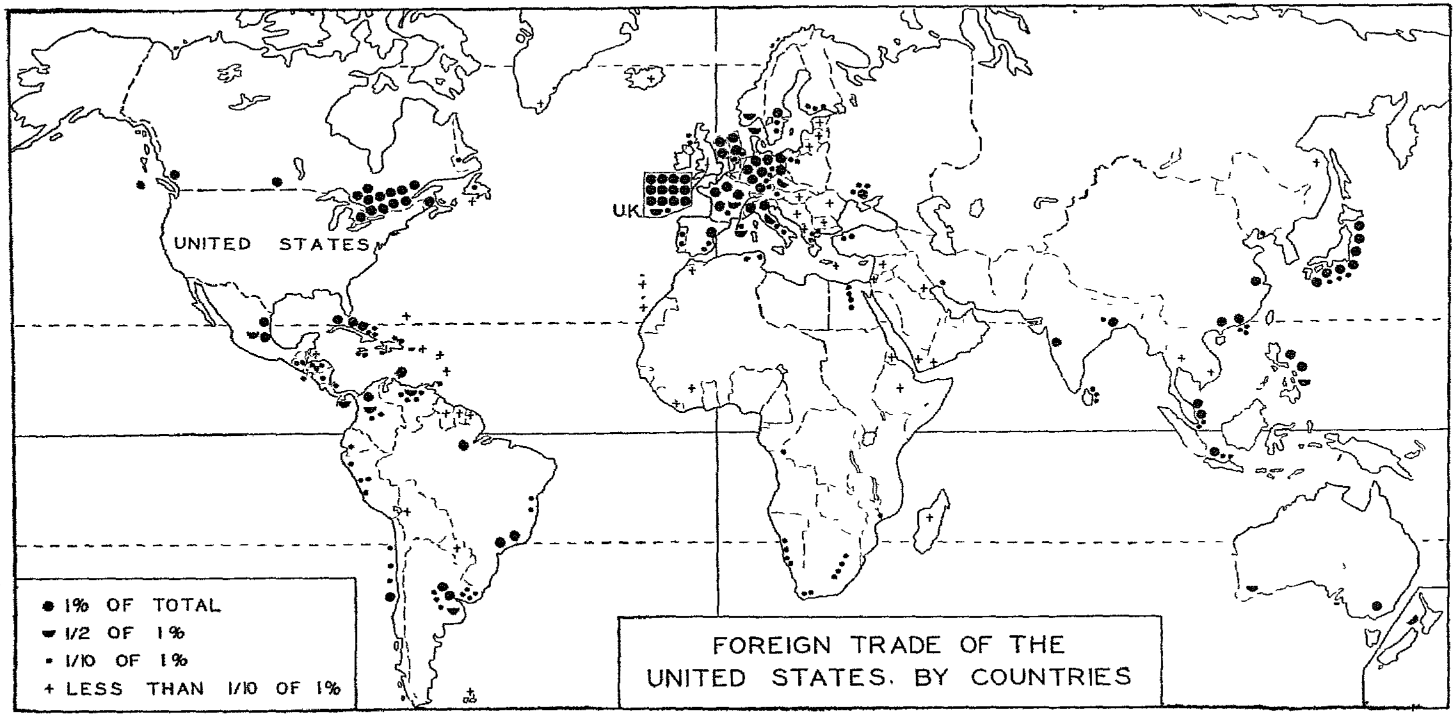



FIG 334 This map shows that we trade with most countries in the world From many distant places we obtain the things necessary in our daily life To satisfy our wants we buy from and sell to many regions all over the world

trade connections, our loans and investments in Europe, and differences in population density, stage of farming and animal husbandry, stage of manufacturing, resources, and standard of living. This region is so advanced in manufacturing, that it has an enormous surplus of manufactured goods. We buy high-grade cotton, woolen, and linen textiles, tin plate and tin bars, and leather goods from the United Kingdom; chemicals, leather, high-grade textiles, paper, cutlery, small hardware, and medical instruments from Germany; silks, laces, leather goods, precious stones, and perfumes from France; precious stones from Holland and Belgium; watches, clocks, and laces from Switzerland. This region also sends us prepared foodstuffs. France, Switzerland, Holland, Denmark send us cheese; Norway, Holland, and the United Kingdom send us fish. Raw materials from this region include wood pulp, hides, furs, and wool.

In return for these products we send Europe a great variety of things. Manufactured goods include industrial, electrical, and agricultural machinery, automobiles and parts, sewing machines, office equipment, and refined petroleum products. However, foodstuffs and raw materials comprise the bulk of our shipments to these countries. They buy from us especially pork products, wheat, flour, canned fruits, and vegetables. They buy corn, meal, and cottonseed cake for animal feed. They take refined copper and tobacco. Cotton and petroleum products make up two-fifths of our exports to this region.

**Trade with the Mediterranean Region.** With the great development of Mediterranean agriculture and grazing this region produces several things which the United States cannot easily produce in large amounts. We get most of our pickled olives, olive oil, cork, long-fiber Egyptian cotton, currants, and attar of roses from this region (p. 176). In addition we buy lemons, walnuts, almonds, peppers, hides, wool, tannin extract, tomatoes, wines, and many small manufactured wares. Though many sections have developed manufacturing, the region looks to the United States and northern Europe for most of its requirements of iron and steel, machinery, automobiles, petroleum products, and lumber. The region also buys from us wheat, flour, tobacco, chemicals, and large quantities of raw cotton. What are the chief bases of our trade with this region?

**Trade with Canada.** Most of our imports of paper, wood pulp, pulpwood, lumber, asbestos, and nickel come from Canada. The forest products make up more than one-half of these imports. Both asbestos and nickel are scarce in the United States. We also buy quantities of copper, silver, gold, furs, wheat (chiefly re-exported) and late vegetables, especially potatoes. We sell to Canada coal, coke, petroleum products, all classes of machinery, iron and steel mill products, refined metals, automobiles, chemicals, textiles, cotton, sulphur, fruits, and vegetables. This interchange of products takes place chiefly between the eastern portions of the two countries. The western plains and mountains, which are quite similar, produce similar products; consequently, there is little basis for direct trade between the western portions.

Canada ranks first or second in our

trade, only the United Kingdom, in some years, has a greater trade with us Many conditions favor our great trade with Canada Canada joins us on the north The railways and highways of the two areas join at many points Cheap and efficient transportation on the Great Lakes and the St Lawrence binds the two areas together The Canadians are like us in habits, customs, and language, their high standard of living creates a demand for many products Their cold climate prevents a large production of things we can produce and ship to them. The mineral resources of the two countries are very different Canada produces little coal and petroleum, but it mines most of the world's asbestos and nickel Canada's stage of industrial development is not as advanced as ours Though the country is larger than the United States, it has only one-twelfth as many people. Finally, we have invested nearly two billion dollars in Canadian enterprises and they have large investments in this country

**Trade with "Tropical America"** Of great importance to us is our trade with the tropical lowlands and subtropical highlands of Mexico, Central America, the West Indies, northern South America, and Brazil Several conditions favor our trade with these regions tropical and subtropical climates, mineral resources, nearness of much of the region, excellent steamship facilities, our control of the Panama Canal, our huge investments in the different areas, and the general lack of manufacturing industries are some of these.

Mexico sends us products from four different types of regions. From its hot wet lowlands we get coffee, vanilla, bananas, chicle, and tropical hard woods, from Yucatan, henequen, from the northern and western irrigated lands, cotton and winter vegetables, especially tomatoes and green peas, and from the mountains, lead, zinc, copper, and silver In exchange for them we ship industrial machinery, steel products, mining machinery, agricultural implements, electrical machinery, lard, wheat, corn, lumber, and petroleum products

The Caribbean region, which includes the West Indies, Central America, and northern South America, supplies us with many things that we can obtain more easily here than from any other region A large part of our sugar comes from the islands Our bananas come almost entirely from the hot, humid lowlands of the islands, Central America, and northern Colombia. Obviously we do not bring bananas from the tropical lowlands farther south as we can obtain all we need from the regions nearer to our ports (p. 117). These hot lowlands furnish us with cacao, tropical lumber, dyewoods, chicle, rubber, Panama hats, vegetable ivory (*tagua* nuts), and other nuts. The lowlands of Colombia and Venezuela send us petroleum (p. 302). We get from the subtropical highlands about two-fifths as much coffee as we obtain from Brazil. Colombia sends us platinum and emeralds; Trinidad and Venezuela, asphalt, the Guianas, bauxite.

From Brazil we buy more than half of our coffee, large quantities of cacao, hides, and products gathered from the tropical forests of the Amazon lowland. Also we import industrial diamonds and manganese from eastern Brazil. Thus, the com-

modities we buy from Tropical America consist almost entirely of raw industrial materials and foodstuffs The United States is the best customer for most of the countries and islands in this region, in most cases we take more than half of their exports

This great region has few manufacturing industries Consequently it has to import most of its requirements Manufactured articles make up about four-fifths of our total shipments to this region Machinery for tropical industries is the leading class of exports to the area and includes machinery for sugar refining, drilling oil wells, refining petroleum, mining and crushing minerals, washing and preparing coffee and cacao, and electrical machinery for providing light and power Enormous quantities of iron and steel sheets, bars, rods, and pipe are used in constructing buildings, bridges, roads, railways, port facilities, and water supply systems Engines and dynamos are required in most of the industries and on the railroads In addition to these iron and steel goods, plows, tractors, wire, hoes, and machetes come from the United States

Though people in this region do not heat their homes they need fuel for power and light and gasoline for automobiles. Railways, mines, *centrals*, and small factories use coal and fuel oil. Most of the people in the rural areas use kerosene lamps None of these countries has sufficient coal and only four produce petroleum (pp. 284 and 302) Even these four send crude oil to the United States or Europe to be refined. Coal, fuel oil, kerosene, and gasoline are among our important exports to the region.

Except for Brazil we ship to this region large quantities of textiles Most of the people are poor and the weather is hot and humid Consequently cotton cloth and cotton wares provide the only cool, cheap, and durable clothing Some of the wealthy wear silk. All areas import cotton, silk, and rayon hosiery, as well as cotton and jute bags in which to ship many of their products

Also, the United States ships foodstuffs to this tropical region, including flour, lard, rice, smoked and salted fish, pork, and canned goods

The chief bases of trade between the United States and this wide area are differences in climate, resources, and stage of industrial development The climatic differences give rise to a trade of a permanent character While these areas are not likely to develop modern manufacturing on a large scale, the difference in industrial development is likely to be a permanent basis of trade.

**Western South America.** From Peru, Bolivia, and northern Chile we obtain materials for our factories Long-fiber cotton for high-grade textiles and tire fabrics comes from the coastal desert of Peru; vanadium and copper from the Andes of Peru, copper, tin, and several alloy minerals from the mountains of Bolivia, copper, nitrates, and iron ore from northern Chile The Panama Canal, American steamship lines, and investments in all these enterprises favor this trade. In addition these areas manufacture little, so they buy from us the usual list of manufactured wares, from heavy mining machinery to hoes and shovels They buy also automobiles, refined petroleum prod-

ucts, flour, canned goods, meats, lumber, and textiles

**Southern South America.** The temperate countries of southern South America do not have great manufacturing industries, consequently they look to us for the same manufactured products as other portions of South America. Of course they buy much more agricultural machinery, automobiles, petroleum products, windmills, wire, and other things needed on the great farms and ranges. On the other hand we do not need their temperate foodstuffs because we produce these things. Therefore these countries send us wool, hides, linseed, and *quebracho* extract in large amounts and meat extract, canned meats, and fruits in our winter season in small quantities. These sparsely populated countries with abundant agricultural resources have a high per capita buying power. We sell to them more than we buy from them because the bulk of the foodstuffs goes to Europe. Naturally in return Europe sends manufactured wares of a great variety.

**Other Temperate Regions of the Southern Hemisphere.** Our trade with New Zealand, Australia, and South Africa is similar to that of southern South America. Turn to page 408 and pick out the commodities which we buy. Why do we buy more rabbit and opossum skins together than hides (p. 78)? Their foodstuffs go almost entirely to Europe. Why do sausage casings, made especially from the intestines of sheep, come in large quantities to the United States? What are the chief bases of trade between the United States and these regions?

**Our Trade with Southeastern Asia.** Our largest trade in this region is with Japan and China, but we have an active trade with the Philippines, Malaya, British India, and the Dutch East Indies. Except for Malaya, our trade with each of these latter units is as large as our combined trade with Chile, Peru, and Bolivia. Our trade with the Philippines shows the influence of political control and investments in the islands. In contrast to Canada and other American regions we have relatively small investments in southeastern Asia.

Our chief exports to China and Japan are raw cotton for their new textile mills, tobacco leaf and cigarettes, petroleum products (especially kerosene and gasoline, although they have poor roads and cannot afford many automobiles, p. 148), iron and steel products, industrial and electrical machinery, wheat and flour, and lumber. Raw silk makes up four-fifths of our imports from Japan and one-third of those from China. Also we import from China especially hides and furs, vegetable oils, eggs, and minerals — tin, tungsten, and antimony. We import also from Japan especially tea, prepared sea foods, straw hats and mats, camphor, and many small manufactured wares. What are the chief bases of our trade with these two countries?

To southern Asia we sell the same things that we ship to China and Japan, and cotton textiles in addition. In turn these areas supply most of our imports of several materials: Manila hemp, jute, rubber, tin, copra, coconut oil, tea, and spices. Except in the Philippines, we buy much more from these areas than we sell to them. In competition with Europe we are not able to sell many articles to the

European colonies in this region Give other trade bases with this area

**The Importance of Foreign Trade to the United States.** Throughout our study of economic geography we have learned that the United States is tied by trade to nearly every region of the world To keep our farmers busy we must have markets for the surplus production of foodstuffs and raw materials. To keep our factories running we must import raw materials that we cannot produce and we must find markets for surplus production. To maintain our high standard of living we must have many articles, like rubber, tin, hemp, vanadium, bauxite, asbestos, sugar, coffee, and spices Our standard of living is in direct proportion to the number and quantity of articles we consume Take away our imports and we should be without such useful necessities as the automobile, electricity, telephones, daily newspapers, breakfast coffee, afternoon tea, airplanes and streamlined trains If these and other essentials were eliminated, our standard of living would drop to where it was nearly a century ago We must work out means of trading with people who want to exchange products with us For a mutually valuable interchange of goods, we must know more about our industries and those of other peoples To us this is the great purpose of the study of economic geography. It is basic to an understanding of international problems, whether they be economical, political, or social.

## EXERCISES

1 List the ways the location of the United States favors trade.

2 (*a*) How has the character of our trade changed during the last fifty years? (*b*) What two regions now supply nearly 60 per cent of our imports and take nearly 60 per cent of our exports? (*c*) In percentage of total trade, what regions have advanced greatly? (*d*) Why have we entered new regions for imports?

3. (*a*) What are the bases of our great trade with western Europe? (*b*) What products do we buy from western Europe? (*c*) Why do raw materials and petroleum products make up such a large part of our exports to western Europe?

4. What are the bases of our trade with the Mediterranean region?

5 (*a*) List several reasons to explain why our trade with Canada is large. (*b*) Little trade takes place between western United States and western Canada. Why?

6. (*a*) In table form list our important imports from Mexico, Central America, the West Indies, northern South America, and Brazil (*b*) Make a list of our important exports to the region as a whole. (*c*) What are the bases of this trade? (*d*) Why is the trade likely to become more important?

7 (*a*) Contrast in some detail our trade with western South America with that of southern South America (*b*) In table form make a list of the things we buy from Argentina, South Africa, Australia, and New Zealand (*c*) Why do we not take the foodstuffs of these countries?

8 Outline the chief characteristics of our trade with the regions in southeastern Asia.

9. Why is foreign trade essential to the United States?

10. From one of the statistical sources cited below, obtain the figures for our leading twenty-five imports and twenty-five exports and make two line graphs showing our exports and imports; let one-half inch on the bars equal $50,000,000.

## TWO EXTRA LESSONS

I "A Detailed Study of the Import Trade of the United States" — A, II (1926), 230–249 (rather difficult).

II "The Ports of the United States" — 19, pp 302–323, 15, pp 204, 207–223

## READINGS

"The Commerce of the United States" — 19, pp 293–302

"The United States as a Market" — 15, Chapter XXII

"Trading with the Tropics" — A, I (1925), 396–401

"Our Trade with the American Tropics" — 12, Chapter III

"The Regions with which We Trade" — 12, pp 30–54

"Foreign Countries as Markets" — 15, Chapter XXIII

"Caribbean Tropics in Commercial Transition" — A, II (1926), 494–507

"Statistics of our Imports and Exports" — 30, I (Foreign Trade of the United States), 105 (annual), 40.

"Trade with Colombia and Venezuela" — 75, pp 320–324, 367 ff

## TOPICS FOR INVESTIGATION AND REPORT

"Our Competitors in South American Trade" — (Have one student take the United Kingdom, one take Germany and another take France as special reports) 75, Chapter XIII or A, III (1927), 409–433.

"The Banana in Caribbean Trade" — A, VIII (1932), 262–273.

"Our Trade with Argentina and Uruguay" — 75, pp 84–88, 278–279.

"Our Trade with Brazil" — 75, pp 134–137

"Our Trade with Chile, Peru, and Bolivia" — 75, pp 186–189, 235–239, 410–413

"Trade with Ecuador" — 75, pp 422 ff

[3] Numbers and letters refer to Selected References on pages 420–424

# SELECTED REFERENCES

The references are divided into five groups In the first group are thirty selected books that make a good workable library for a small high school, they are used frequently in the lists of readings and topics In the second group are pamphlets which may be obtained free or at very small cost. Teachers, by writing to the companies, can build up an excellent reference list of these materials The third group contains books of more detailed and advanced treatment. The fourth group is three selected magazines that have been used frequently in the lists of readings and topics Teachers will find the National Geographic Magazine readily available and should make the other two available through the school library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